

The Foundrymen's

Own

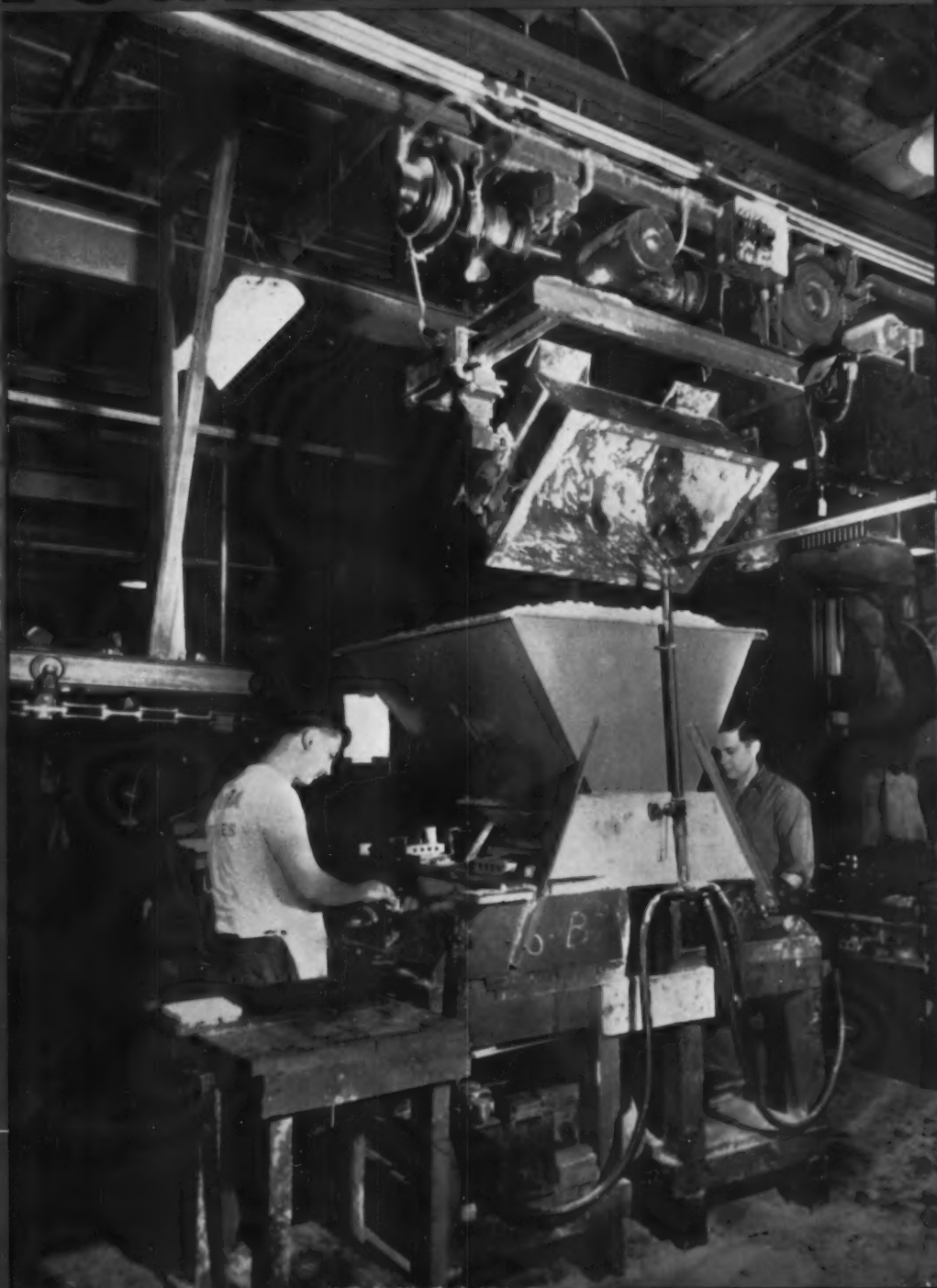
Magazine

Foundryman

American

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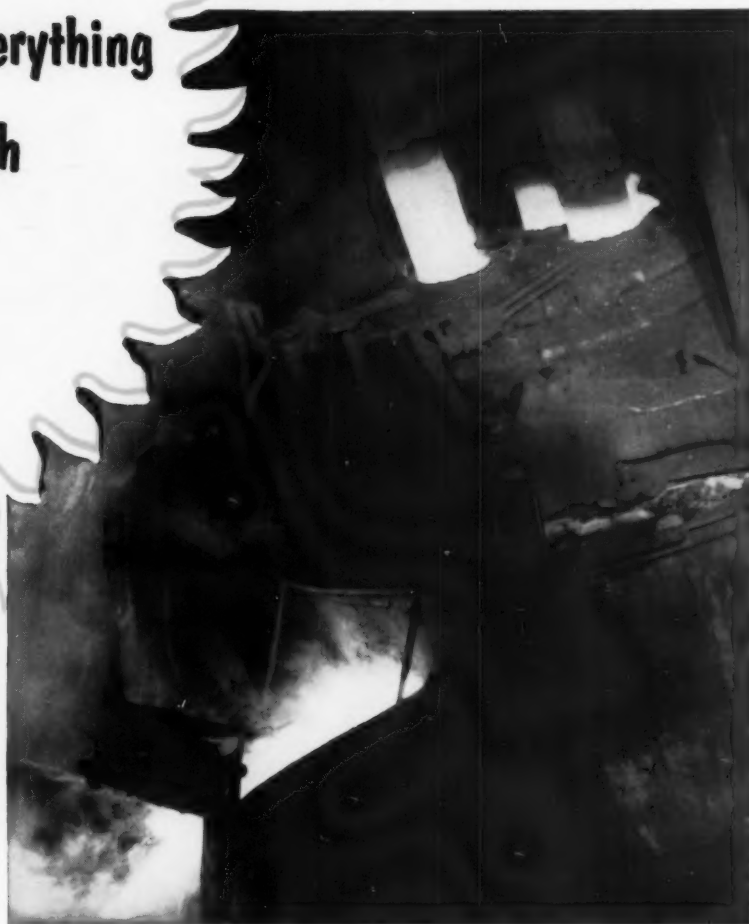
JULY
1954



**"We're melting everything
under the sun with
our Lectromelt*
Furnace."** —

says:

M. C. Stephens, Jr., Melting Supervisor
Ross-Meehan Foundries
Chattanooga, Tenn.



This size P. T. furnace rated at 3½ tons per hour
is the larger of two Lectromelts which are contributing to
the versatility of Ross-Meehan Foundries' operation.

**"We're a job foundry.
It's good business to be so versatile."**

"... Out of 11 heats turned out in 17 hours of one day, eight were of different alloys. Every day we produce three to five different metals as standard procedure, including Ni-Resist, 28 chrome and Meehanite. And the ease of making a special heat of steel in a Lectromelt* Furnace helps us a lot. It seems that everything about a Lectromelt is just right for our production."

This production man is talking about his foundry job. He has seen the value of precise control

of temperature and analysis made possible with a Lectromelt Furnace. The flexibility of production, the versatile nature of a Lectromelt and the matter of casting special heats and special alloys daily... these could make your foundry more efficient and capable—could let you go after more profitable castings business.

Write for Lectromelt Furnace Bulletin No. 9. Request any engineering information you require. Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

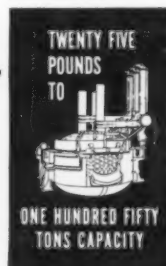
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General Electrica Espanola, Bilbao ... ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT...

Lectromelt



THREE'S A CROWD..



... but in this case, three sand additives make a perfect slurry!

A well known production foundry recently sought means to improve their molding sand slurry mixtures. After exhaustive tests, using every possible type of sand additive, they found that a combination of three particular additives gives them excellent control of all vital sand characteristics—with much less strain on their pumping system and pipe lines.

As a base for their slurry, this foundry uses #1200 Slurry Grade, Granulated, Federal GREEN BOND Bentonite. This top quality, western bentonite goes into slurry *quickly*. Its medium viscosity in solution, plus its exceptionally high strength, makes possible the addition of exactly the right amount of bentonite to the slurry for maintenance of desired green strength. Up to 2% more Slurry Grade, Granulated GREEN BOND can be added without straining the pumping system.

The addition of Federal SAND STABILIZER and Federal CROWN HILL Seacoal to the bentonite slurry provides the necessary flowability and carbon content—resulting in more uniform mold hardness and better shakeout conditions. Furthermore, the Federal SAND STABILIZER *sharply reduces the viscosity of the slurry*, without decreasing green strength. This makes it possible to *increase* the percentage of Granulated GREEN BOND Bentonite added to the slurry—producing a more highly concentrated strength per gallon of slurry—with *less strain* on the pumping system and *no clogging* of pipe lines.

If you use the slurry system of sand bonding in your foundry, you'll want to learn more about these efficient Federal slurry additives. We'll gladly consult with you about them, or send complete information.

FEDERAL

Make your foundry a better place in which to work!

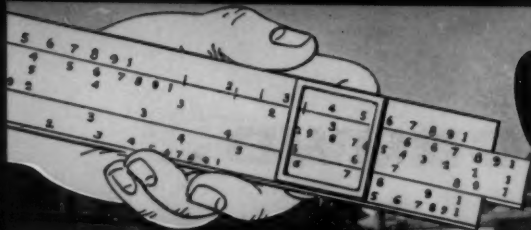


The FEDERAL FOUNDRY SUPPLY Company

4600 EAST 71ST STREET, CLEVELAND 5, OHIO

CROWN HILL W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND VA. • ST. LOUIS • CHATTANOOGA • NEW YORK • UPTON WYD.

IN TWIN CITIES, C. D. GILBERT COMPANY, 512 2ND AVENUE, MINNEAPOLIS



Costs on CHARGING and MELTING

Are Down Because

this major producer* of castings has planned well with MODERN engineers in the synchronization of every handling operation:

*Lacey Foundry Corporation, Muskegon, Michigan is a major producer of grey iron castings for the automotive, agricultural and household appliance industries.

The 165 cu. ft., self-tripping bucket conveys coke and stone, by crane, from car unloader to bin and batch lorry. Scrap and pig are charged directly into the weigh hopper.

All components flow mechanically from gondola cars, through MODERN 108" cupolas, to the molds on the pouring floor. Undercar unloaders... coke and stone buckets... bins... hoppers... scales... MODERN Small-Cone charging bucket... inclined-swivel charger and the melting equipment team together to pull down costs while boosting the over-all quality.

Much of this controlled, time-proved mechanization is described in bulletin S-147-B. A note on your letterhead will start our thinking about ways to cut your costs RIGHT NOW while we're planning together for tomorrow's expansion...



EQUIPMENT COMPANY
Port Washington, Wisconsin

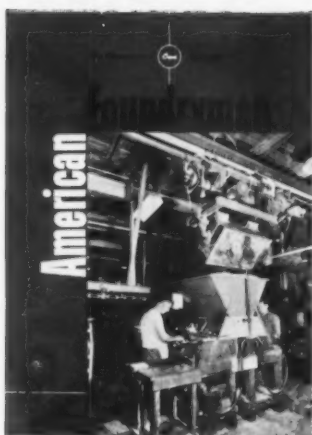
American Foundryman

Volume 26

July 1954

Number 1

Published by American Foundrymen's Society



Forest City Foundries Co., Cleveland, uses monorail unit to automatically deliver conditioned sand to core-makers' stations.

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July 1954 • 3

500,000 castings without a reject by using RESINOX 1128 bonded shells



Gray iron is poured into 34 molds from one ladle as they pass on a conveyor belt. Permeable sand-Resinox 1128 shell molds permit gases to escape, eliminate many metallurgical defects such as blowholes, porosity and cold shuts.

That's the record of
Midwest Foundry Co.,
Coldwater, Michigan

Half a million items, cast to a tolerance of .010" without a single reject . . . labor costs reduced more than half . . . 12 pounds of finished product for every 15 pounds of metal poured . . . elimination of machining on intricate designs . . . 20% lighter molds, on the average . . . up to 4 times more production per man hour—these shell molding advantages reported by Midwest Foundry Company are typical of those experienced by foundries throughout the country.

"We are producing a cylinder liner with thin vertical walls demanding very close tolerances, by shell molding with Monsanto Resinox 1128," reports Mr. Albert H. Doerr, Chief Engineer. "The high flow characteristics of Resinox 1128 combined with the integral core features of shell molding give us high quality finish, clean stripping and closer dimensional tolerances than with any other combination . . . and we are getting these results with an exceptionally low 5% resin-to-sand ratio."

The success of the shell molding process is heavily dependent on the quality of the resins used. That's why more and more foundries are specifying Monsanto *Resinox* shell molding resins to get consistently better castings at lower cost. You'll find that research-proved and shop-tested Monsanto foundry resins will meet your most exacting production requirements.

For complete information on Resinox shell molding resins, phenolic and Resimene urea resins for core binding, and Lytron sand conditioner for conventional sand casting, mail the convenient coupon today.

Resinox: Reg. U. S. Pat. Off.

MONSANTO CHEMICAL COMPANY, Plastics Division, Room 5606, Springfield 2, Mass.

Please send me complete information on:

☐ Resinox shell molding resins; ☐ Monsanto phenolic resins; ☐ Monsanto core binding resins; ☐ Lytron sand conditioner.

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Company _____

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City, Zone, State _____



Most for your electrode dollar...

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Carbon and Graphite

Electric Furnace Electrodes

Specify National Carbon's Furnace Electrodes with complete confidence on two counts:

- **PRODUCT QUALITY**, recognized to be the finest in the industry.
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Here are the two basic ingredients of electrode economy — proved *superiority of product and technical-service* organized specifically to help customers put this quality to work for greatest electrode economy. Repeatedly this service to the industry has recommended details of electrode operating practice, resulting in more efficient power utilization, better joints and joining procedure, and attractive electrode savings.

Take advantage of this specialized knowledge. Write or call National Carbon Company for complete details.

FOR ELECTRODES AND ELECTRODE SERVICE...

Rely on NATIONAL CARBON COMPANY!

The term "National" is a registered trade-mark of Union Carbide and Carbon Corporation

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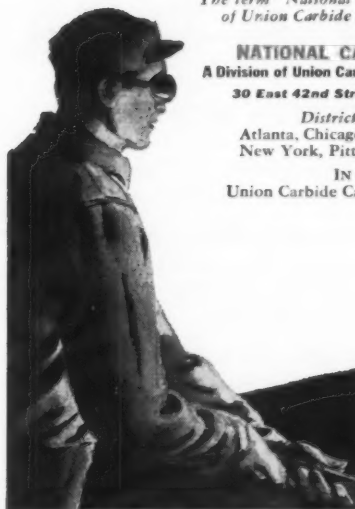
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NATIONAL CARBON PRODUCTS ➡

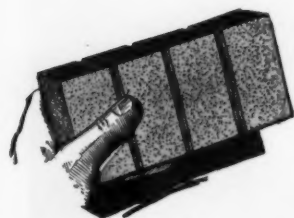
**BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER
BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS**

*Don't
"Hang"
Your
Profits*



Famous CORNELL CUPOLA FLUX

CLEANSSES MOLTEN IRON FOR BETTER CASTINGS AND MINIMUM SCRAP LOSS.



SCORED BRICK FORM

There are still a few foundries where profits are lost before metal is poured, due to impurities in molten iron.

Don't let this happen to you — whether you operate a gray iron foundry or malleable foundry with cupolas. Make sure your iron is absolutely clean before a cupola is tapped, by adding a little Famous Cornell Cupola Flux to every charge of iron. Besides, being free of all foreign matter your iron will be

hotter, more fluid — and sulphur reduced (in many cases) to practically nothing.

You will pour castings that are sounder, cleaner, easier to machine — and cupola maintenance will be greatly reduced because cupolas are kept cleaner.

You will use a flux that requires but a few seconds' time for every cupola charge and practically no labor.

WRITE FOR BULLETIN NO. 46-B

The Cleveland Flux Co.

1026-1040 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes — Since 1918



BRASS FLUX

FAMOUS CORNELL BRASS FLUX cleanses molten brass even when the dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

ALUMINUM FLUX

FAMOUS CORNELL ALUMINUM FLUX cleanses molten aluminum so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive formula reduces obnoxious gases, improves working conditions. Brass contains no metal after this flux is used.

Industrial

PUSH-TYPE CRANES

ECONOMICALLY HANDLE HEAVY CASTINGS



Hoisting a 300 lb. casting off the floor to a machine is done in a moment—easily and safely with an economical Industrial Crane.

You, too, perhaps could facilitate the machining of those heavy parts in your shop or speed loading of your trucks by using Industrial Push-Type Cranes.

Whenever efficient hoisting and handling of machines or objects is a problem, Industrial Cranes can provide an economical answer. Industrial Crane & Hoist Corporation builds quality cranes for every purpose, in models to suit different requirements, hand operated and motor driven in capacities up to 20 tons.

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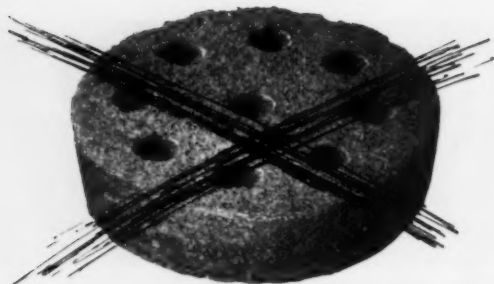
Send Copy of Push-Type Crane Bulletin No. PT-1253.

Name

Company

Address

City, State



SHOP-MADE SAND CORES ARE OBSOLETE!

A few years back, foundries had to use shop-made sand cores. That's all they had. Costly rejects losses, dirty metal, and extra machining time were an inevitable part of the cost of producing castings.

Today that's not true. As foundry after foundry has discovered, you can slash rejects losses to a minimum, reduce machining time, and produce better castings, often at less cost per core, with AlSiMag Ceramic Strainer Cores.

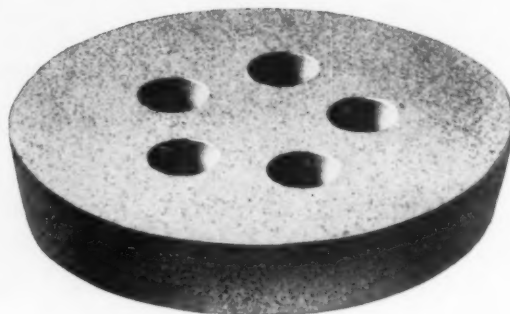
The reason is simple—AlSiMag Ceramic Strainer Cores are made of a material specifically developed after years of research for the greatest possible resistance to heat shock. As a result of our extensive high-speed production facilities, they can be produced at less cost than most shop-made sand cores!

TEST THEM IN YOUR OWN FOUNDRY

Try AlSiMag Ceramic Strainer Cores—let your own experience tell the story. Test samples of standard sizes free on request. Samples made to your specifications at reasonable cost.

WRITE TODAY

USE **ALSiMAG[®]** *Ceramic* **STRAINER CORES**



- Resistant to heat shock
- No erosion at normal pouring temperatures
- Non-spalling
- Completely free of gas
- Not affected by moisture
- Strong, will stand the roughest handling
- Do not contaminate scrap
- Flat and uniform

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53rd YEAR OF CERAMIC LEADERSHIP



Here's how to eliminate crane down- time due to summer heat

Is your foundry constantly plagued with that annual problem of increased crane downtime caused by summer heat? With ambient temperatures of 120 to 150 F over pouring, heat-treating and similar areas accentuated by high summer temperatures . . . plus dust, dirt and fumes . . . it's no wonder that crane operators need frequent relief—relief that results in *crane downtime and lost production!*

These problems are eliminated with Dravo Crane Cab Conditioners. The crane cab conditioner maintains a summertime temperature in the cab of 80 to 85 F . . . filters out dust, dirt and fumes . . . keeps crane operators alert and efficient . . . permits them to work long periods without

relief. Dravo Crane Cab Conditioners will assure regular crane operations during those summer hot spells and help maintain production.

Get complete information *today* about how Dravo Crane Cab Conditioners can eliminate these problems and save you money! Mail the coupon.

DRAVO

C O R P O R A T I O N

PITTSBURGH, PENNA.

Sales Representatives In Principal Cities

Dravo Corporation, Air Conditioning Department
Fifth and Liberty Avenues, Pittsburgh 22, Penna.



- ☐ Please send Bulletin 1301 "Crane Cab Conditioners."
- ☐ Please send Bulletin 1304 "Cool Off the Hot Spots."
- ☐ Please have a representative call at no obligation to me.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

NATIONAL BENTONITE

•
*First choice with
many good
foundrymen
for years!*



Why you can count on NATIONAL for better bonded molds . . .

Many good foundrymen have known, for years, that National Bentonite helps them bond a better mold because of these important qualities: consistently uniform high quality . . . good green strength . . . high hot strength . . . high tensile strength . . . high sintering point . . . good mold durability . . . and close laboratory control. They know, too, it yields high permeability, provides high deformation, and requires least water to temper correctly. This all means better production, fewer rejects, and less time in the cleaning room.

Baroid



*Quick service from better
foundry suppliers everywhere*

Baroid Sales Division ☆ National Lead Company

Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

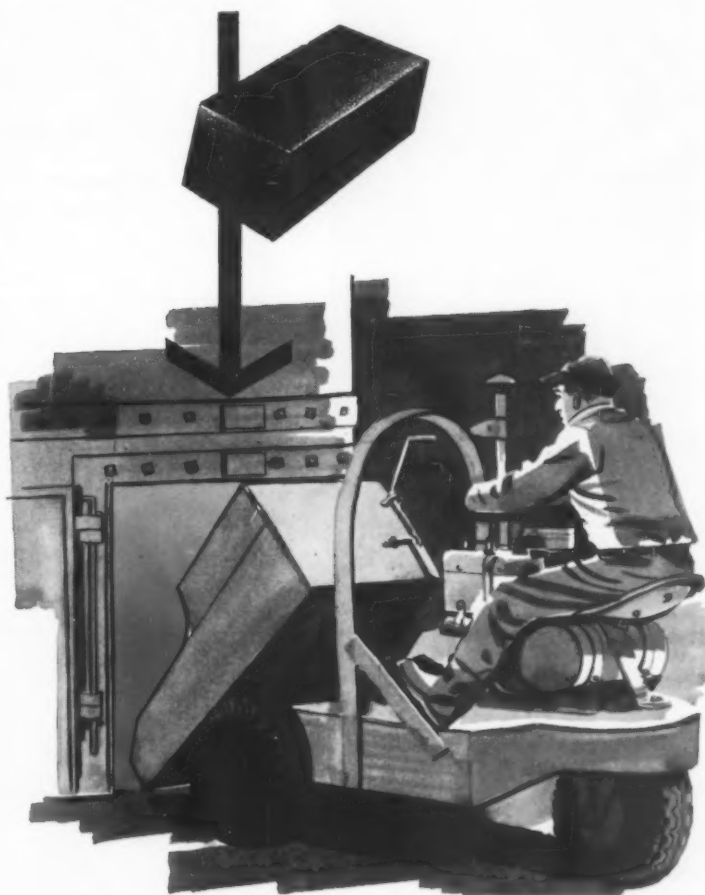
the same results at lower cost with— **MEXITE.**

Mexite briquettes, composed of 70% graphitic carbon, provide foundrymen with a positive method of raising and stabilizing the carbon content of cupola charges and at the same time reduce the cost. Larger amounts of scrap can be used with resultant savings in charging costs. For example, if 400 lbs. additional scrap is charged, four Mexite briquettes will retain the same carbon analysis at a savings of \$3.06* per ton of charge.

Mexite briquettes help produce better castings because they permit accurate carbon control. Mexite helps assure lower chill and hardness, and provides better fluidity and machinability thus increasing useable metal yield and cutting scrap loss. Mexite briquettes are packed 90 lbs. to a carton for easy handling and storing. We'd like to show you what Mexite can do in your foundry

... write us today for a specific recommendation made for your particular area. We'll also send along our newest bulletin that will show you how Mexite can help keep your costs down where you want them to be.

*Based on average current pig iron and scrap prices



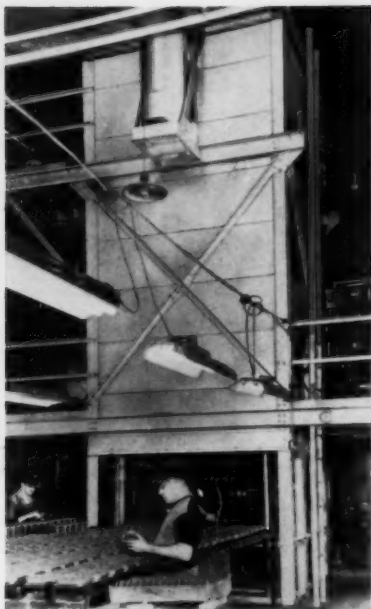
OUR 100th YEAR

100

THE UNITED STATES GRAPHITE COMPANY
DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

July 1954 • 11

Products and Processes



Tower Core Oven

Coleman Tower Oven, for mechanizing the small foundry corerom, is equipped with accurately controlled low thermal head heating system for flexible operation. Ovens are designed to handle conventional oil, fast-bake oil, or synthetic resin binders. Large and small cores can be baked together without over baking thin sections or sharp edges, it is claimed. Built-in cooling system smokes-off and cools the cores before they are unloaded. Recovered heat is used over again for fuel economy. *Foundry Equipment Co.*

For more data, circle No. 356 on p. 17

Pocket Flowability Test

No. 840 Rowell Flowability Test gives a good idea whether a sand will ram readily against all surfaces of a pattern. Only special equipment necessary to conduct this test, according to the literature is an elliptically shaped metal plate which rests in the 2 in. I.D. standard sand test specimen tube at a 60° angle and a metal plate approximately 3 in. long curved on a 1 in. radius, 1 3/4 in. on one end and 3 in. wide on the other end before shaping. The lower end (in ramming position) of the elliptical plate is cut off to form a chord of the 2 in. circle (specimen tube) that is 1/4 in. deep. Flowability is expressed as percentage calculated from hardness measurements at two points. *Harry W. Dietert Co.*

For more data, circle No. 357 on p. 17

New Aluminum Cleaner

Development of Oakite Composition No. 161, an alkaline-type material designed to clean aluminum, steel and other metals in pressure-spray washing machines without objectionable foaming, has been announced. Composition No. 161, the manufacturers state, is a white, free-flowing, powdered material that is completely soluble in water, free rinsing, and inhibited to provide safety to aluminum. *Oakite Products, Inc.*

For more data, circle No. 358 on p. 17

Respirator

A single respirator which protects the wearer against toxic dusts as well as organic vapors has been developed. Called the new MSA Comfo Chemical Cartridge Respirator, it employs static-web dust filters which clamp on the respirator's twin chemical cartridge filters. The dust filter is made of charged, resin-

treated felt which promotes electrostatic retention of dusts and supplements mechanical filtering action. Cartridges and filters for the new respirator are independently replaceable. *Mine Safety Appliances Co.*

For more data, circle No. 359 on p. 17

Pneumatic Hammer

Airmite Air Hammer, recently introduced, weighs only 3 1/2 lb. without a tool, is 7 in. long, and fits the hand like a pistol. It has a convenient "firm arm" type trigger. A recessed air control screw in the handle is turned to adjust the air flow—one direction to increase impact, other way to lessen impact. Operates on air pressure as low as 40 lb. Safety ports release air when tool is idling. Hammer will not operate unless tool is pressed against work. A wide range of tools are available for use with the Airmite. *Dotmar Industries, Inc.*

For more data, circle No. 360 on p. 17

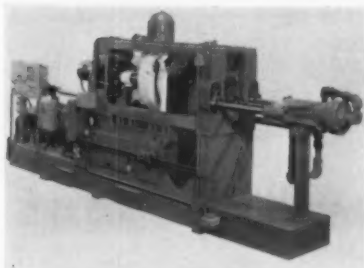


Portable Vacuum Cleaner

Hoffco-Vac No. 75 is a high capacity, heavy-duty portable vacuum cleaner. Unit operates two 1 1/2-in. hoses up to 100 ft long simultaneously and has a dust container 7 1/2 cu ft. Machine, equipped with special nozzles, can be used to clean intricate cavities in molds and cores, eliminating need for blowing

or shaking dirty castings. Unit can also be used for shot removal. It moves easily and is easily emptied. A winch system lowers the full dust bucket to the ground. Casters on the bottom of the bucket make it simple to roll it to the disposal point for emptying. *U. S. Hoffman Machinery Corp.*

For more data, circle No. 361 on p. 17



Die Casting Machine

Designed to cast up to 4½ lb of aluminum, or proportionate weights of magnesium or brass, the HP-1-C die casting machine will accommodate dies up to 25 in. wide or 22 in. high. Unit has a positive toggle clamping pressure of 200 tons. With the patented central die height adjusting screw, dies can be set to open a fraction of a thousandth of an inch at full clamp—taking advantage of the full locking pressure and still getting “metered breathing” or venting. Machine has two accurately aligned shot positions and is readily converted to zinc die casting. *Lester-Phoenix, Inc.*

For more data, circle No. 362 on p. 17

Steel Number Stamp

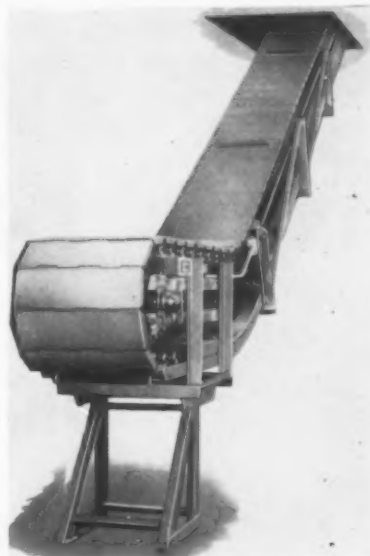
A device for marking numerals in nameplates, castings, and products of metal, etc., is the Acme Number-8. Can be used for serial numbering from zero to 999,999 or for repeating a number or succession of numbers as often as desired. Suitable for use by hand or in machines. *Acme Marking Equipment Co.*

For more data, circle No. 364 on p. 17

Inspectroscope

Model E. C. M. Inspectroscope, operating on the same principle as the gastroscope used by doctors, now aids inspection of machinery, dies and other products with cavities. Production men can now place the tube along narrow passages or into molded cavities. Inspectroscope fits through a ½ in. opening, and the thin tube contains a complete set of tiny lenses. As many as 60 of these precision lenses reflect the image back and forth to the inspector's eye. A strong light illuminates the area looked at. To fit around corners, a control wheel on the handle curves the tube so that almost all areas of the cavity can be seen. *Eder Instrument Co.*

For more data, circle No. 365 on p. 17



Steel Belt Conveyor

Steel belt conveyors in widths from 12 to 60 in. and any length from 10 ft up, have been added to the Weld-Bilt line of materials handling equipment. Long life and low operating friction are claimed with the Weld-Bilt conveyors. They are made up of 14-gauge cold finished steel sections which move on ball bearing rollers and greased sealed, hardened runways. The sections are continuously hinged with ¼-in. bolt pins. Changes in belt lengths are easily made, it is claimed. *West Bend Equipment Corp.*

For more data, circle No. 366 on p. 17



Here's How the Progress Pattern and Foundry Co., St. Paul, Minn., has reduced the cost of sealing porous castings and increased the permanency of the seal by using the Tinchler metallic impregnation sealing process, which incorporated the impregnation developments, formerly, a varnish-type sealer used. Only one rinsing in water is necessary to clean metallic sealed castings compared to at least two baths in expensive solvents for those treated with varnish. The metallic seal is more permanent, according to the foundry, because it is not adversely affected by heat and certain solvents as are varnish sealants. Leaker castings in the basket in front of the operator are lowered into the autoclave at the operator's right hand, the cover is tightly closed and the air evacuated. Hot sealant from the rectangular tank at the right is then drawn in by the vacuum. When the autoclave is full of sealant, 85 psi is applied inside the autoclave for 15 minutes to drive the sealant into the castings. The basket and castings are then rinsed in a tank of water next to the autoclave. *Tinchler Products Co.*

For more data, circle No. 363 on p. 17



Swing Frame Grinder

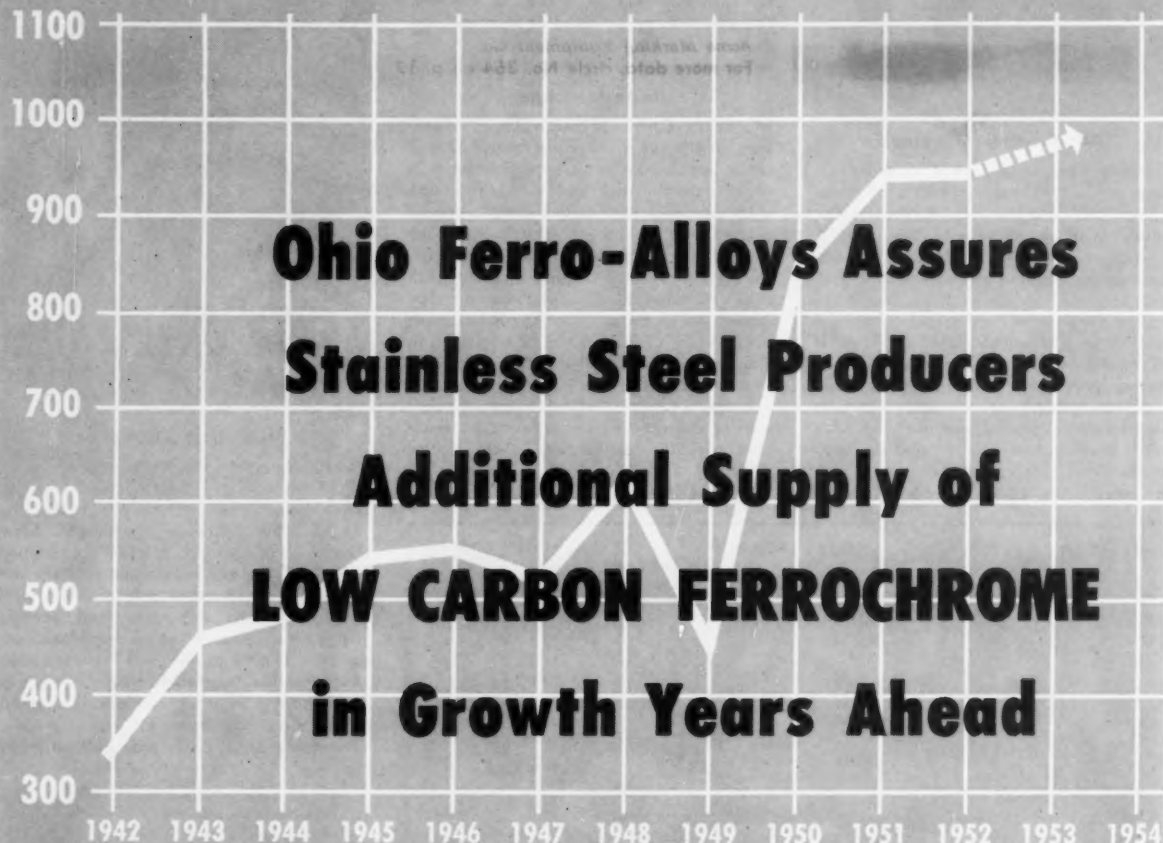
One of several new machines being made for Curtis Machine Corp by an affiliate company in Germany, is a versatile Swing Frame Grinder, Model PB-1, for use with a grinding wheel, buff or abrasive belt. Grinder, which can be used in small, as well as large plants, can be suspended and thus brought to heavy or bulky work. It can be rigidly mounted and used as a variety grinding and polishing unit, such as mounting on a lathe for OD grinding and polishing. Features include: maneuverability, positive and convenient tracking mechanism belt tensions, compact design, rugged construction, adjustable balance and high speed. *Curtis Machine Corp.*

For more data, circle No. 367 on p. 17

continued on page 17

STAINLESS STEEL INGOT PRODUCTION

TONS
(Thousands)



**Ohio Ferro-Alloys Assures
Stainless Steel Producers
Additional Supply of
LOW CARBON FERROCHROME
in Growth Years Ahead**

*Source: American Iron & Steel Institute

Since it was introduced in the 20's, production of stainless steel has more than doubled every decade. Industry leaders confidently predict this growth will continue despite temporary interruptions. There have been times in recent years when shortages of Low Carbon Ferrochrome severely hampered stainless production. To assure producers an adequate supply in the growth years ahead, Ohio Ferro-Alloys Corporation has added Low Carbon Ferrochrome to its line of quality ferro-alloys. Production schedules permit immediate shipment of these grades:

Max. 0.04% carbon	Max. 0.15% carbon
Max. 0.06% carbon	Max. 0.20% carbon
Max. 0.10% carbon	Max. 0.50% carbon

Other Ohio Ferro Products

- | | | |
|--|-----------------------------------|--------------------|
| • FERRO - SILICON 25 - 50 - 65 - 75 - 85 - 90% | • LOW CARBON FERRO-CHROME SILICON | Briquets |
| • SPECIAL BLOCKING 50% FERRO - SILICON | • FERRO - MANGANESE | |
| • SILICON METAL | • SILICO-MANGANESE | |
| • HIGH CARBON FERRO-CHROME | • BOROSIL | |
| | • SIMANAL | |
| | • RARE EARTH ALLOYS | • SILICON |
| | | • MANGANESE |
| | | • SILICO-MANGANESE |
| | | • CHROME |



Ohio Ferro-Alloys Corporation
Canton, Ohio

Chicago Detroit Pittsburgh Tacoma Seattle
Minneapolis Birmingham San Francisco Los Angeles

COLEMAN OVENS

*reduce waste ...
lower costs*

in every type of foundry

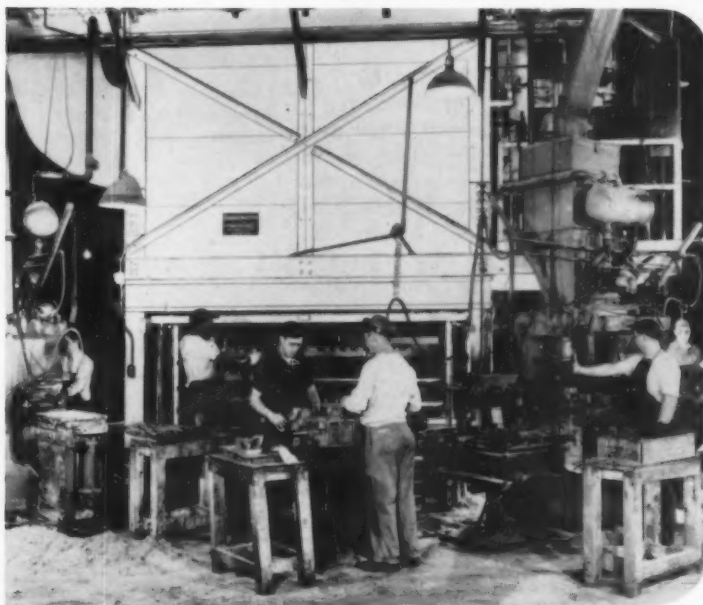
You can reduce casting scrap . . . cut your labor, material and fuel costs by baking cores and drying molds in Coleman Ovens. Small and large foundries alike find that Coleman Ovens are vital to better quality castings and increased profits.

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

Coleman Engineers have pioneered and developed the most efficient oven designs to meet the highly specialized needs of modern foundry methods in all classes of work — grey iron, malleable, steel, alloy, brass, aluminum and magnesium.

Profit by this experience — let us recommend, at no obligation, the Coleman Oven for your needs.

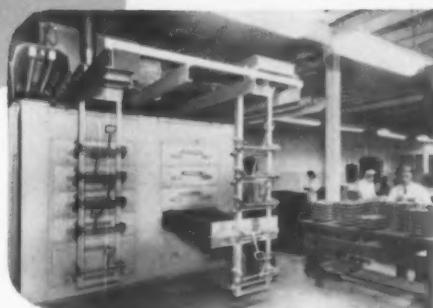
Write for Bulletin 54



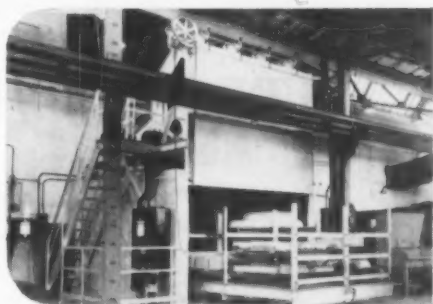
Coleman Tower ® Oven in Automotive Foundry

THE FOUNDRY EQUIPMENT COMPANY
1825 COLUMBUS ROAD CLEVELAND 13, OHIO

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS



Coleman Rolling Drawer Ovens
in Brass Fittings Foundry



Coleman Car-Type Oven
in Steel Foundry



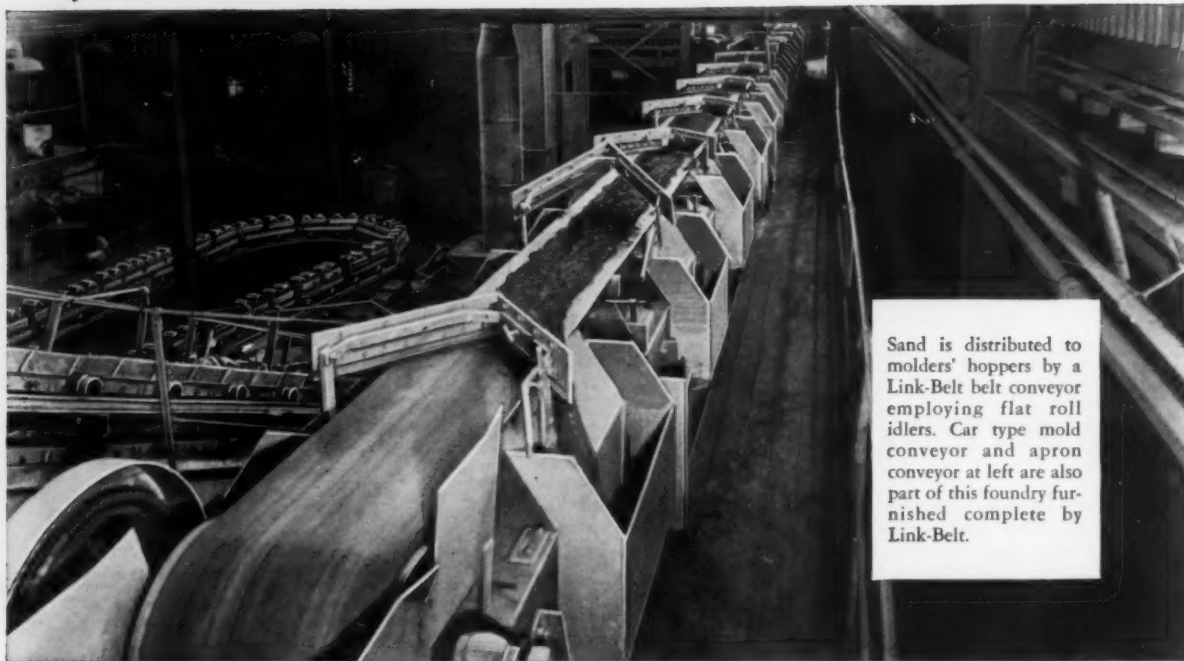
Coleman Dielectric Core Oven
in Aluminum Foundry

A COMPLETE RANGE OF TYPES AND SIZES

*for every core baking and
mold drying requirement:*

Tower Ovens • Horizontal Conveyor Ovens
Car-Type Core Ovens • Car-Type Mold Ovens
Transrack Ovens • Rolling Drawer Ovens
Portable Core Ovens • Portable Mold Dryers
Dielectric Core Ovens





Sand is distributed to molders' hoppers by a Link-Belt belt conveyor employing flat roll idlers. Car type mold conveyor and apron conveyor at left are also part of this foundry furnished complete by Link-Belt.

SURE ROAD TO LOWER HANDLING COSTS

... carry the load via Link-Belt belt conveyors

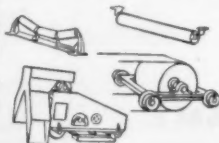
**LINK-BELT offers you
the "total engineering"
so necessary for top efficiency**



DESIGNED FOR OVERALL EFFICIENCY—Because of its unrivaled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most

practical way to fit individual conveyors into your overall system requirements for best results.

BUILT FOR LONG-LIFE PERFORMANCE—Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the specific job.



DELIVERS FULL RATED

CAPACITY

—Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews at the customer's request.



ASSURES SATISFACTORY

PERFORMANCE—When you rely on Link-Belt as a single source for your complete system, we accept responsibility for placing it in full operating readiness. We will also super-

vised modernization of existing systems. For all the facts call your nearby Link-Belt sales representative.

LINK-BELT
BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

19,466-D

Products & Processes

Continued from page 13

Fill out postcard below for complete information on items listed on pages 12, 13, 17, 18, 20, and 102

Marking Stick

Sample Paintstik for your particular marking requirements is now available by furnishing details as to the type of surface to be marked, condition and temperature range. Manufacturer claims Paintstiks can be used for marking surfaces up to 2,000 F and will not run, char or flow. Colors are fadeproof. Markings can be removed in pickling bath. *Markal Co.*

For more data, circle No. 368 on card

Abrasive Wheels

Flextes, a new abrasive product, is being introduced. New line consists of mounted points, straight wheels, depressed center discs and cutoff wheels. Flextes is an all purpose wheel for roughing and finishing practically any material in one operation, it is claimed. It is a blending of abrasive grains, synthetic fibres, and a specially developed binding agent. *Metal Removal Co.*

For more data, circle No. 369 on card

Thread Compound

New high temperature thread compound that protects against the welding action of threaded connections subjected to prolonged exposure to extreme heat has been developed. Known as Thred-Gard, it is said to eliminate seizing and galling at operating temperatures up to 1200 F. The compound is non-hardening and acts as a lubricant to allow easy disassembly of threaded connections, even after lengthy service under the most severe conditions. By reducing wrench torque, Thred-Gard allows fittings to be drawn up to a greater degree of tightness without undue stress or strain, it is pointed out. Acts as a protective coating to keep threaded surfaces smooth and insure pressure-tight, metal to metal contact. *Crane Packing Co.*

For more data, circle No. 370 on card

Cut-Off Saw

New, versatile abrasive cut-off saw has been announced. According to the manufacturer, new unit permits fast, square and practically burr free cuts of tubular sections up to 4½ in. OD or equivalent relieved shapes—solids up to 3 in. diameter. Abrasive wheel mounted on ball bearing spindle maintains perfect alignment—cuts straight through work held on both sides of the wheel path for positive clamping—reducing the chief cause of wheel breakage. Powered by 7½ hp motor, with interchangeable vee belt

pulleys to drive the 16 in. cutting wheel at the proper speed for abrasive wheel or metal blade cutting. Wheel is quickly changeable in its swinging type guard. Chips and dust deflector on table plate protects operator. Tubular steel frame anchors to floor. Completely enclosed motor, drive and cutting wheel are balance-mounted on shielded ball bearing pivot unit. *Wallace Supplies Manufacturing Co.*

For more data, circle No. 371 on card

Level Indicator

Robintronic Level Indicator uses a radio signal to indicate and control the level

of stored material. Unit consists of a small radio transmitter housed in a steel probe which is placed at the level where the flow of material is to be controlled. When the stored material rises and envelops the probe (or drops and exposes it) the change in surrounding density distorts the signal being broadcast to the remote control unit. This change then either sets off an alarm or actuates the mechanism which regulates the flow of material. *Hewitt-Robins, Inc.*

For more data, circle No. 372 on card

Acetogen Gas

Manufacturer of Acetogen Gas has a patented system of mixing city gas (natural or artificial) with Acetogen. This, it is claimed, takes the place of and eliminates the acetylene generator. Other advantages claimed are: quick pre-heating; minimum hardening effect on metals; no carbon or soot deposits; no change of equipment necessary, except use of Acetogen tip in the torch; savings in cylinder handling, and low range of inflammability. *Acetogen Gas Co.*

For more data, circle No. 373 on card

Reader Service Dept.

54/7

Please send me detailed information on the Products and Processes.

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Free Foundry Information

Fill out postcard below for complete information on items listed on pages 12, 13, 17, 18, 20, and 102

D Process

Technical Bulletin No. 200 deals with the D Process for Shell Molding. Discussed are: sands employed; binder used; release agents; formulations; mixing cycle, and working with the sand. Drier design, baking and founding, are also included in the pamphlet. *Archer-Daniels-Midland Co.*

For more data, circle No. 374 on card

Portable Crane

Bulletin P. G. 244-53 illustrates and describes the telescopic portable gantry crane for production, maintenance and installation. Included is outline dimensions of the crane with application of

various types of spur geared chain hoists. Three capacity breakdowns by tons are also listed. *Industrial Crane & Hoist Corp.*

For more data, circle No. 375 on card

Core Wash

A kit of technical bulletins on core wash is now available. Folders cover 180-D core coating; steel core and mold wash; No. 125 core wash for brass and bronze; No. 114 core coating; Tri-Cote core wash, and preparation of core wash solutions for coating dry and green sand cores. *Frederic B. Stevens, Inc.*

For more data, circle No. 376 on card

Vibrating Conveyors

Bulletin No. 135-A describes line of vibrating conveyors. Amply illustrated with pictures of typical installations handling such material as red hot steel castings, scrap metal, sand, shredded wood bark, and crushed limestone, the bulletin covers technical details of both Rockermount and Springmount type conveyors. *Hewitt-Robins, Inc.*

For more data, circle No. 377 on card

Dust Control Systems

Dorfan dust and fume control systems are detailed in new four-page bulletin recently published. In these systems a recirculating or parallel flow granule principle is used for removal of smoke, fumes, moisture and for reclaiming by-products. Systems are recommended for the collection of fumes from dryers of all types, electric steel furnaces and a great variety of other installations. *Mechanical Industries, Inc.*

For more data, circle No. 378 on card

Aluminum-Magnesium Alloy

Information Sheet No. 33 covers aluminum-magnesium alloy-BS 1490-LM 10. Booklet lists chemical composition, mechanical properties, casting characteristics, melting considerations, melting procedure, casting temperatures and molding technique. Gravity die casting is also included in the brochure. *Foundry Services, Ltd.*

For more data, circle No. 379 on card

Chromium Conservation

Modern techniques for controlling the structure of gray cast iron and for recovering chromium from discard slags in steel-making are described in the Spring 1954 issue of "The Vancorom Review." It is pointed out that while certain qualities of gray cast iron may be enhanced by adding small amounts of either of two types of inoculants, increased quantities of inoculants are not proportionately more beneficial. Three methods of achieving chromium conservation are outlined in the booklet. *Vanadium Corporation of America.*

For more data, circle No. 380 on card

Skid Box

New 48-page catalog describes several new products, including steel boxes with lap joints, a stand and reel for handling steel coils and a new type nesting stacking box. Another new item listed is a skid box with a side door which provides easy access to materials without removing stacked boxes. *Palmer-Shiel Co.*

For more data, circle No. 381 on card

Fire Clay Refractories

Handbook of fire clay refractories designed to afford information as a handy reference, provides tables, charts and other data for those using, installing or specifying fire clay refractories. Chapter headings include, Research and Quality Control, Fire Clay Brick, Standard and Series Shape, High Temperature Refractory Specialties and Glass Industry

continued on page 20

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CITY AND ZONE

DELTA

Core and Mold Washes

for
Closer Tolerance..
Better Finish Castings

... Lower Cleaning
Room Costs.....

... Less Scrap...

IMPORTANT REASONS WHY MORE FOUNDRIES USE DELTA CORE AND MOLD WASHES TO SPEED PRODUCTION AND REDUCE COSTS

DELTA CORE AND MOLD WASHES "Anchor" themselves by penetrating from 4 to 7 grains deep into the sand. This bond between the wash and the sand . . . an exclusive DELTA feature . . . produces an expansion-resisting coating essential to the production of finer finished castings.

The dry compression strength increases with each degree rise in temperature up to 500° F when the hot compression strength takes over. The hot compression strength increases with each degree of temperature rise up to 2900° F. The ultimate hot compression strength of the wash is over 1000 p.s.i.

There is no gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only DELTA CORE AND MOLD WASHES provide this unique and all-important insurance against defective castings resulting from gas leakage.

DELTA

There is a DELTA Wash for every type of Metal Casting.

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

**MILWAUKEE 9,
WISCONSIN**

Free Information

continued from page 18

Refractories. Spiral bound, the handbook is sectionalized for greater convenience and contains a unique section finder, affording a quick method of locating wanted information. *Walsh Refractories Corp.*

For more data, circle No. 382 on p. 18

Alloy Contamination

Kramer Alloy News, Vol. No. 28, contains information on aluminum and silicon contamination in the copper-tin-lead bearing alloys. Chemical analysis and tensile test results are given. Use of phosphor copper in the brass and bronze foundry is also included in the brochure. *H. Kramer & Co.*

For more data, circle No. 383 on p. 18

Specification Chart

Useful calculating wheel created as an aid to designers, engineers or anyone requiring a quick source of all the physical properties of the various types of Meehanite metals, is found in the new Meehanite "Physical Specification Chart for Engineering Design." Chart provides the engineering characteristics of all metals in the four major classifications under which Meehanite castings are produced. *Meehanite Metal Corp.*

For more data, circle No. 384 on p. 18

Surface Treatment

New booklet describes the pioneering and progress in the development of equipment for the surface treatment of metal products. Brochure gives a picture and word "visit" with manufacturer so that a more comprehensive and cohesive understanding of the organization, facilities, products, purposes, experiences and policies are available. *N. Ransohoff, Inc.*

For more data, circle No. 385 on p. 18

Gates and Risers

Lavingot Technical Journal Vol. 9 No. 4 contains a complete article entitled "Gates and Risers for Manganese Bronze." Eight-page bulletin contains many other interesting references. *R. Lavin & Sons, Inc.*

For more data, circle No. 386 on p. 18

Materials Handling

Bulletin 8764-10M-3-54, "Engineered Materials Handling Systems," describes and illustrates specific industrial examples of Gifford-Woods material handling systems, including: complete handling system for bulk chemicals; chip-handling system for metal-working industry; drum-handling system for chemical processing; raw-materials handling for can manufacturer; coal-handling system for industrial plants; and sand and flask handling system for foundry. Each system is described, illustrated and diagrammed. A section on mechanical methods of transferring

or feeding bulk materials includes illustrations and text on nine different types of elevators, conveyors and feeders. *Gifford-Wood Co.*

For more data, circle No. 387 on p. 18

Speedmullors

"The Speedmullor," new 36-page bulletin, points out how an extensive design program has further improved mulling action of the equipment. Described and illustrated in detail are six models with various capacities of from 6½ to 76 tons of fully mulled foundry sand per



hour. Coverage is also given to auxiliary Speedmullor equipment, as well as important power economies, low-maintenance features, engineering, dimensional and installation data and production-boosting facts. *Beardsley & Piper, Div. Pettibone Mulliken Corp.*

For more data, circle No. 388 on p. 18

Core Binder

Technical Bulletin F-4 lists the composition and characteristics of Foundrez 7990, dual-purpose core binder. Advantages, method of use, and baking, are also discussed in the bulletin. *Reichold Chemicals, Inc.*

For more data, circle No. 389 on p. 18

Bonding Clays

Bulletin No. 1 lists a comparative study of bonding clays. Divided into three sections, bulletin discusses: analysis of clays and their functions in molding sands; comparison of sand properties using different clays, and durability of bond clays. *Illinois Clay Products Co.*

For more data, circle No. 390 on p. 18

Tool Shape Chart

"Carbide and Abrasive Tool Shape Identification Chart" illustrates in actual size the various shapes of the firms mounted points. Carbide burr shapes are also illustrated, with dimensions and prices listed. Three tables presenting data on tap drills, twist drills and steel wire gauge, as well as decimal equivalents, are also included. *Metal Removal Co.*

For more data, circle No. 391 on p. 18

Spectrophotometry

Booklet, "What Every Executive Should Know About Spectrophotometry," explains how a spectrophotometer works and lists some of its uses. Colored charts are used to illustrate certain points. Transmission (absorption) measurements, reflection measurements and flame measurements are discussed. *Beckman Div., Beckman Instruments, Inc.*

For more data, circle No. 392 on p. 18

Manganese Bronze

Better Castings, Vol. XXIV, No. 3, discusses producing Manganese Bronze with definite physical properties. Manufacture of manganese bronze has been simplified by the use of "Falls" No. 21, booklet claims. It consists of three steps: melt copper and "Falls" No. 21 together; add zinc, and flare. Pamphlet also covers "Falls" No. 154 alloy, 4-11-44 alloy, 50-50 ferro nickel and copper shot for addition to cast iron. *Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc.*

For more data, circle No. 393 on p. 18

Foundry Information

Bulletin FY-140-R, Useful Information for Foundrymen, lists some practical data pertaining to various foundry operations. Publication gives pointers on cupola operation and cupola linings; thermal properties of metals; melting points of minerals and oxides; data on combustion; average range of crane speeds, and many other useful topics. *Whiting Corp.*

For more data, circle No. 394 on p. 18

Stainless Steels

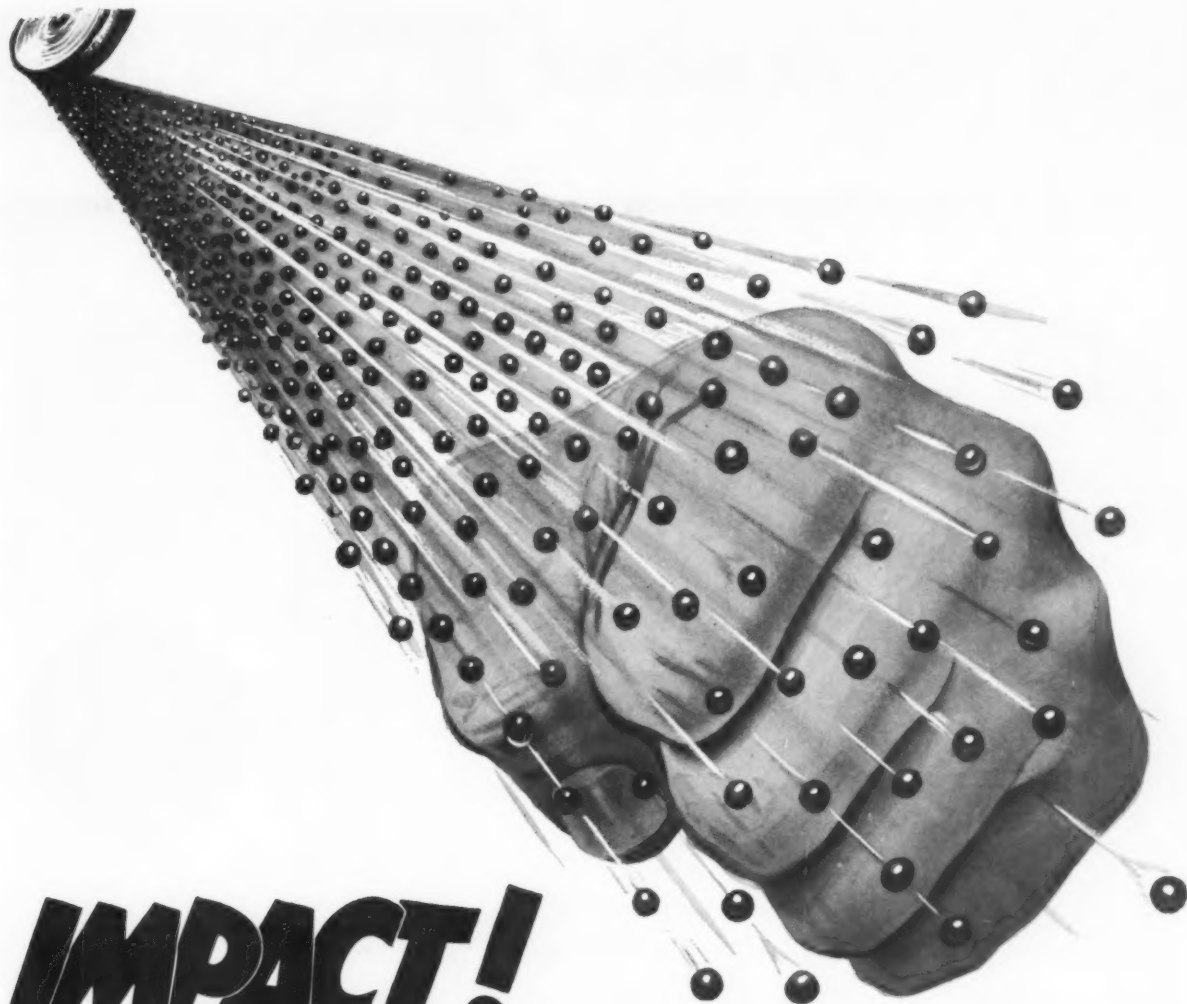
Bulletin No. 454-S is a designation chart for cast stainless steels. Chart designates specifications, analysis, physical properties and uses of a number of corrosion resistant and heat resistant stainless steels. In addition, principal alloying elements are given, and helpful remarks regarding behavior of each steel in use are included. *Empire Steel Castings, Inc.*

For more data, circle No. 395 on p. 18

Blast Machine

Bulletin, No. 114-B, covers blast cleaning by airless means in a tumble-type machine. Describes specifically the 11½ cf capacity Tumblast model in the company's line of airless blasting machines. The unit is intended for high production cleaning of castings, forgings, heat treated parts, weldments, die castings, or stampings, to name a few of the applications. Also covered in general, are the advantages of the airless blast cleaning process. A section of the bulletin is illustrated with installation views. The operation of the machine is explained, and some pictures of typical parts processed in it are shown. Complete electrical and mechanical specifications are given. Case histories are included, which show the type of performance that can be expected from the unit. Bulletin makes mention of seven other sizes of Tumblasts to serve a wide range of industrial requirements. *American Wheelabrator & Equipment Corp.*

For more data, circle No. 396 on p. 18



IMPACT!



MALLEABRASIVE . . . SHOT OR GRIT . . . is packed with blast cleaning power for profitable operation.

Because Malleabrasive is scientifically heat-treated and laboratory-controlled it does a *better, faster* cleaning job. And because it cleans quicker, lasts longer, saves you parts repairs and down-time—Malleabrasive means *cheaper cleaning*.

Words won't prove it—the final test is in *your* equipment. Try Malleabrasive on your jobs and see for yourself. Next time you order blast cleaning abrasive, specify Malleabrasive from PANGBORN CORP., 1300 Pangborn Blvd., Hagerstown, Md.

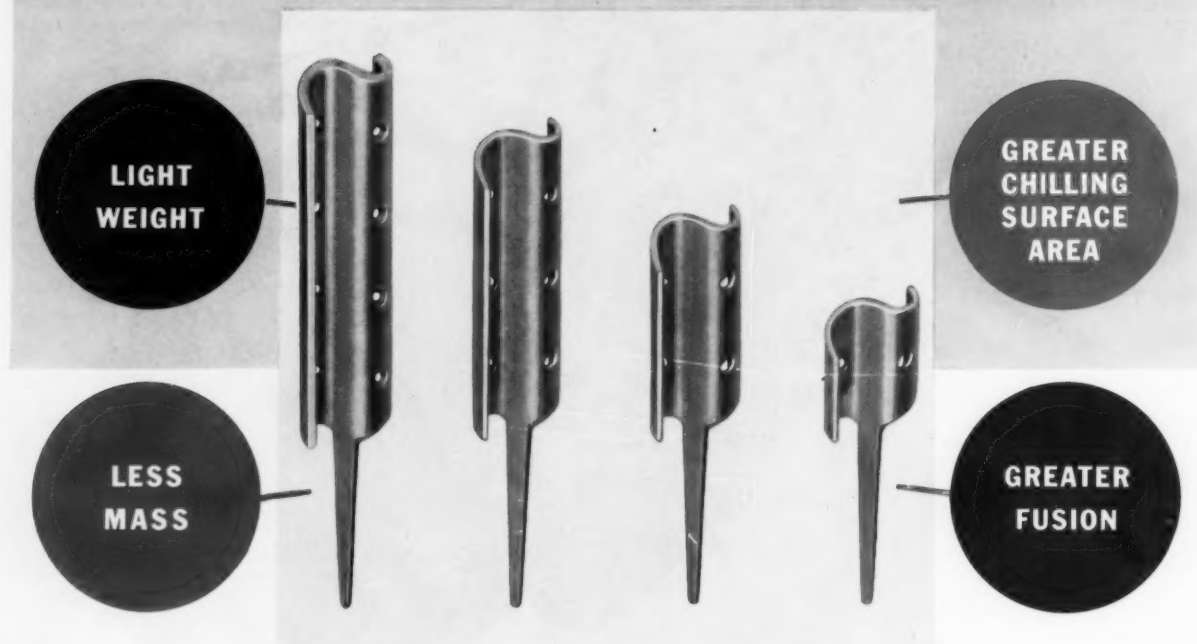
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PANGBORN'S 50th ANNIVERSARY—1904-1954

*U. S. Patent #2184926
 (other patents pending)

Now *fine* **FANNER** **FAN-S-CHILLS**

for general chilling applications—light or heavy sections



Patent Pending

WITH THE EXCLUSIVE DESIGN
THAT PROVIDES FAR GREATER CHILLING *plus* EXTRA SAVINGS IN COST

Here is a fine FANNER Chill that is winning the praise of users everywhere throughout the industry. The Fan-S-Chill is another result of the continuous research and development that have produced so many other fine FANNER Chills.

The Fan-S-Chill, through its curved "S" design offers 75% more chilling surface with less weight since there is no solid mass. Moreover because of its curved "S" design and holes which permit more thorough flow of metal it fuses and locks into the cast metal solidly and completely. Since it is light in weight it offers savings in cost, shipping and handling. Made of formed steel, it is ideal for general chilling purposes, especially in steel.

You will be interested in the many cost saving features of the fine FANNER FAN-S-CHILL, so write today for samples and prices.

THE FANNER MANUFACTURING CO.

Designers and Manufacturers of Fine Fanner Chaplets and Chills
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STANDARD SIZES

1/2" to 4" in length. 1-1/4" in width.
Made in heavy, medium and light gauges. Copper, aluminum or tin coated.

Lighter or heavier FAN-S-CHILLS
in special sizes can be made on request.

The Fanner Engineering Department will cooperate with you on special applications.



The man who uses your castings can **MACHINE UP TO 35% MORE CASTINGS PER TOOL**

Iron deoxidized with FERROCARBO® patented Briquettes is *premium* iron... free from segregations, inclusions, and deep hard chilled spots. It is more easily machined, adds up to 35% to the life of cutting tools... often permits increases in machining speeds. In addition, the castings you supply are finer-grained, denser, stronger than castings made from untreated iron.

You benefit, too, because iron deoxidized with FERROCARBO® is more fluid, flows more readily into thin sections... reduces misruns. Silicon recovery increases materially, allowing you to charge more scrap and still produce better castings.

GET THE COMPLETE STORY today. Call your FERROCARBO Distributor—or write for your free copy of "Producing Superior Gray Iron Castings." Address: The Carborundum Company, Dept. AF84-44, Niagara Falls, N.Y.

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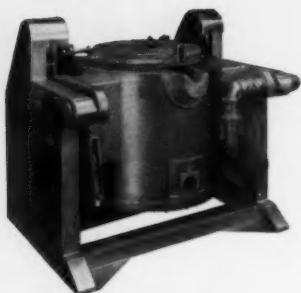
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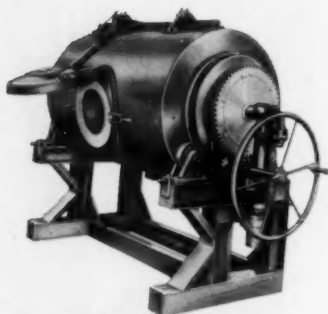
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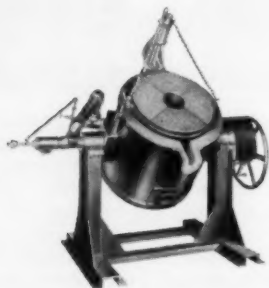
84-44



Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to #800 crucible with brass, up to #1000 crucible with aluminum. Oil or gas fired. Described in Bulletin 57-A.



Lindberg-Fisher Simplex Rotary Open-Flame Furnace. Capacities to 2400 lbs. aluminum. 6000 lbs. brass. Oil or gas fired. Described in Bulletin 29-A.



Lindberg-Fisher type BB1 Hand-Tilt Crucible Furnace. Tilting mechanism consists of a hand wheel, driven through machined worm gear and pinion reducing gears. Capacities 50 to #400 crucible. Oil or gas fired. Described in Bulletin 400.

Melting specialists for 25 years
Sales and service offices in principal cities



Lindberg-Fisher Electric Resistance Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities 250 to #1000 crucible.

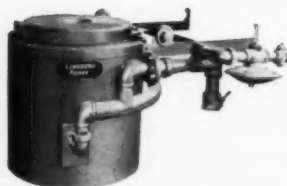
For Non-Ferrous Metals A complete line of



MELTING AND HOLDING FURNACES

For Melting Aluminum • brass • yellow brass
bronze • copper • copper nickel alloys • lead
magnesium • nickel • tin • zinc.

Because Lindberg-Fisher builds *all* kinds of melting equipment... gas... oil... electric... induction, and Carbon arc... L-F engineers are able to recommend, without prejudice, the proper type of furnace for your particular melting requirements.



Lindberg-Fisher type SF stationary crucible furnace features rapid melting and is recommended for general foundry casting work. Capacities 30 to #400 crucible. Oil or gas fired. Described in Bulletin 301.

Visit Lindberg-Fisher exhibit at the Foundry Show, May 8th through 14th, Cleveland, Ohio



MELTING FURNACES

A Division of Lindberg Engineering Company, 2440 West Hubbard Street • Chicago 12 • Illinois

It's easy to fit
core formulations
to casting conditions with
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Using RCI's liquid, water-soluble, thermosetting, urea-formaldehyde resin — FOUNDREZ 7600 — as a sand binder, you can easily develop the core mix that's best and most economical for your casting metal, oven capacity and production rate.

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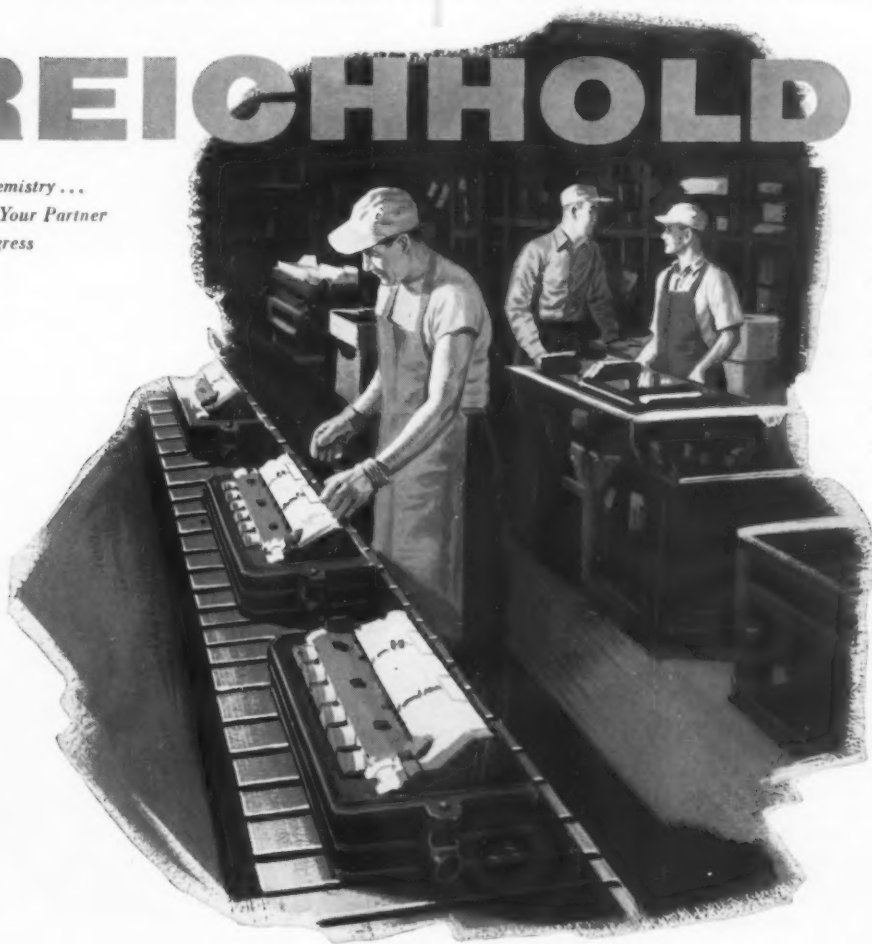
For full data at no obligation, write for Technical Bulletin F-2. RCI's Foundry Technical Service is available to help create the mix most suited to your purpose.

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Foundrymen in the News



R. E. VanDeventer . . . chief metallurgist

R. E. VanDeventer and **Arthur Townhill** recently joined Alloy Engineering & Casting Co., Alloy Casting Div., Champaign, Ill., as chief metallurgist and associate project director, respectively, where they will work on the Castings Potential Project.

B. D. Claffey has resigned as president and general manager of Acme Aluminum Alloys Inc., Dayton, Ohio, and president of William F. Jobbins, Inc., Aurora, Ill. Also resigned as directors are **Henry A. Rudkin** and **C. H. Moen**. Elected directors in their place were **Arthur Linz**, Climax Molybdenum Co., **Franklin Hatch**, Solar Aircraft Co., and **R. H. Money**, Reynolds Metals Co.

Roland E. Erbst has left Kausel Foundry Co., Minneapolis, where he was foundry superintendent, for the same post with State Foundry Co., Akron, Ohio.

Appointments to supervisory posts in the metals research department have been announced at Armour Research Foundation of Illinois Institute of Technology, Chicago. **Dr. William Rostoker** has been promoted to supervisor of physical metallurgy. He formerly taught at Illinois Tech and the University of Birmingham (Eng.) **Dr. Donald J. McPherson**, formerly head of the physical metallurgy section, is now supervisor of non-ferrous metallurgy. **Verne Pulsifer** has been named head of the department's metallography laboratory.

William N. Jove, Chicago area field engineer for Norton Co. of Worcester, Mass., has retired after a career of over 51 years. **William D. Bennett**, abrasive engineer in the Cleveland district, has also retired after 46 years of service. Other Norton personnel changes include: **Fred J. Benn** appointed abrasive engineer, operating out of Louisville, Ky.; and **William Reibitz**, formerly Detroit field engineer, now abrasive engineer for the same area, exchanging jobs with **Allan Jaques**.



A. Townhill . . . associate director

E. C. Wussow, foundry manager since 1942, has been appointed vice-president and foundry manager of Kaukauna (Wis.) Machine Corp.

T. W. Teetor is now foundry engineer with Federal Malleable Co., West Allis, Wis. He was formerly head of the Development, Engineering, and Methods Department of Swayne, Robinson & Co., Richmond, Ind.

Hickman, Williams & Co., Chicago, has elected **F. R. Snyder** a director. A University of Iowa graduate, Mr. Snyder worked with John Deere & Co. Tractor Works at Waterloo, Iowa, for 13 years before joining his present firm, where he has been metallurgical engineer in charge of sales development.

J. E. Bolt has been promoted to application engineer in the Phenolics Engineering Unit, Chemical Materials Dept., General Electric Co., Pittsfield, Mass. Bolt joins GE after three years of active duty with the U. S. naval reserve, before which he was a metallurgist and supervisor at American Brake Shoe Co.



K. W. Cunningham . . . promoted



J. J. Friedman . . . re-elected

Jack J. Friedman has been elected president, Metropolitan Brass Founders Assn., Inc., New York, for a second year. Mr. Friedman is vice-president in charge of production, Bronx Brass Foundry, Inc., where he has been since leaving the service in 1947.

Dr. Alexander R. Troiano has been named head, department of metallurgy, Case Institute of Technology, Cleveland. Dr. Troiano has been serving as acting head of the department since the September death of Prof. Kenneth H. Donaldson, former head.

Juan Latapi Sarre, assistant to the manager; and **Vicente Sanz**, engineer, Fundiciones de Hierro Y Acero, S. A., Mexico City, Mexico, recently visited foundries producing steel railroad castings in Chicago and Cleveland.

H. A. Acheson, Jr., has joined the staff of Acheson Industries, Inc., as assistant to the executive vice-president. He will be located at the Newark, N. J. offices.

Catalin Corp. of America, New York, has announced the affiliation of **W. V. Cleminson** as controller of the firm.

J. G. Pritz and **K. W. Cunningham** have been elected vice-presidents of Ohio Ferro-Alloys Corp., Canton, Ohio. Pritz has been general sales manager since 1947; Cunningham became general manager of production in 1950.

continued on page 28



J. G. Pritz . . . vice-president

RUGGED CASTINGS NEED MOLYBDENUM



Accepted by foundrymen all over the world as an alloy they can use when they really need reliable help, Molybdenum answers all demands.

Alloys of Molybdenum, dissolving rapidly at normal steel or iron melting temperatures are available and their use is widespread.

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Plants: Washington, Pa., York, Pa.



Foundrymen in the News

continued from page 26



J. H. Cadieux . . . new manager

Two appointments have been announced at Misco Precision Casting Co. **J. H. Cadieux** is now manager of the Detroit plant, and **Charles Yaker** of the Whitehall, Mich., plant.

Paul B. Brown was recently made a director of Abrasive & Metal Products Co., and also president of Peninsular Grinding Wheel Sales Corp., and president and general manager of Peninsular Grinding Wheel Division of the parent company.

W. L. Ashlock and **H. F. Grote** have been appointed regional sales managers for the metals division of Olin Industries, Inc. Ashlock will be located at the New Haven, Conn., plant; Grote at Cleveland.

G. K. Dreher, formerly Casting Division manager, Waukesha (Wis.) Foundry Co., has become secretary of Steel Founders' Society of America, Cleveland. A graduate of Lawrence College, Appleton, Wis., he was executive director of F.E.F. for several years, a national director of AFS, and president of the Wisconsin Chapter.



G. K. Dreher . . . S.F.S.A. secretary



C. Yaker . . . promoted

Lindberg Engineering Co. has announced the appointment of **R. A. Hastings** to head up the sales department of a new division of Lindberg, details of which will be announced later. Hastings was formerly vice-president of Continental Industrial Engineers, Inc. **L. H. Remiker** has also been named to head Lindberg's newly-formed Field-erected Equipment Division, which will provide nationwide design and installation service.

F. V. Geier, president, Cincinnati (Ohio) Milling Machine Co., was recently awarded honorary membership in the Engineering Society of Cincinnati, the group's highest honor. Mr. Geier was honored for his long service in behalf of the Herman Schneider Foundation.

Kurt S. Sealander has joined the supervisory staff of Hills-McCanna Co., Foundry Div., Chicago, where he will work as chief metallurgist. Mr. Sealander is a graduate of the University of Minnesota and was formerly chief metallurgist of the magnesium foundry division, Aluminum Co. of America, Buffalo, N. Y.



K. S. Sealander . . . chief metallurgist

D. E. Bender is now assistant purchasing agent, foundry products and supplies section, Allis-Chalmers Mfg. Co., Milwaukee. He started with the company in 1943 and has been an assistant supervisor of the expediting section since 1949.

R. A. Foley has been appointed salesman in the Chicago district office of Lindberg Engineering Co. He comes from 20 years in engineering and sales of electric furnaces with Hevi Duty Electric Co., Jersey City, N. J.

Thomas H. Brumagin was elected a director of Ajax Flexible Coupling Co., Inc., Buffalo, N. Y. He is chief engineer and has been associated with the firm since 1946.

J. W. Frazier has been named field manager of air filter sales by American Air Filter Co., Inc., Louisville, Ky. He will work with the various district sales offices of the company throughout the nation.

Birdsboro (Pa.) Steel Foundry & Machine Co. recently elected several new officers, including chairman of the board and chief executive officer, **J. E. McCauley**, president of the company for the past 20 years; **G. Clymer Brooke**, promoted from executive vice-president to president; **J. M. Heppenstall**, advanced from treasurer to vice-president and treasurer; and **A. L. Wentzel**, former assistant vice-president and works manager, now vice-president and works manager.



J. E. McCauley . . . executive officer



G. C. Brooke . . . new president

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STERLING FLASKS last longer . . . much longer!

● **Rugged**, long-lasting money-savers . . . yes! . . . but you'll find other reasons for wanting Sterling Foundry Flasks. Tensile Strength of 70,000 p.s.i., for instance, is engineered into these rolled steel channel flasks, further fortified by heavy, square-cornered steel flanges. Rigidity is assured by full-width bearing and solid reinforcing-bar around each section. The tremendous pressure-resistance thus built in, is an unequalled safeguard against casting-failures, year

after year. All steel . . . all-welded . . . each section becomes one solid, rigid unit. The partings are precision-machined (planed to .005") and the flanges have plenty of steel for several refinishings if needed. The solid center rib helps to combine super strength and rigidity with light weight that you'll appreciate . . . just as more than 13,000 other foundries do, all over the world. You'll like the way Sterling Foundry Flasks defy rough usage.



This exclusive Sterling feature prolongs flask-life: Partings are precision-planed to .005".



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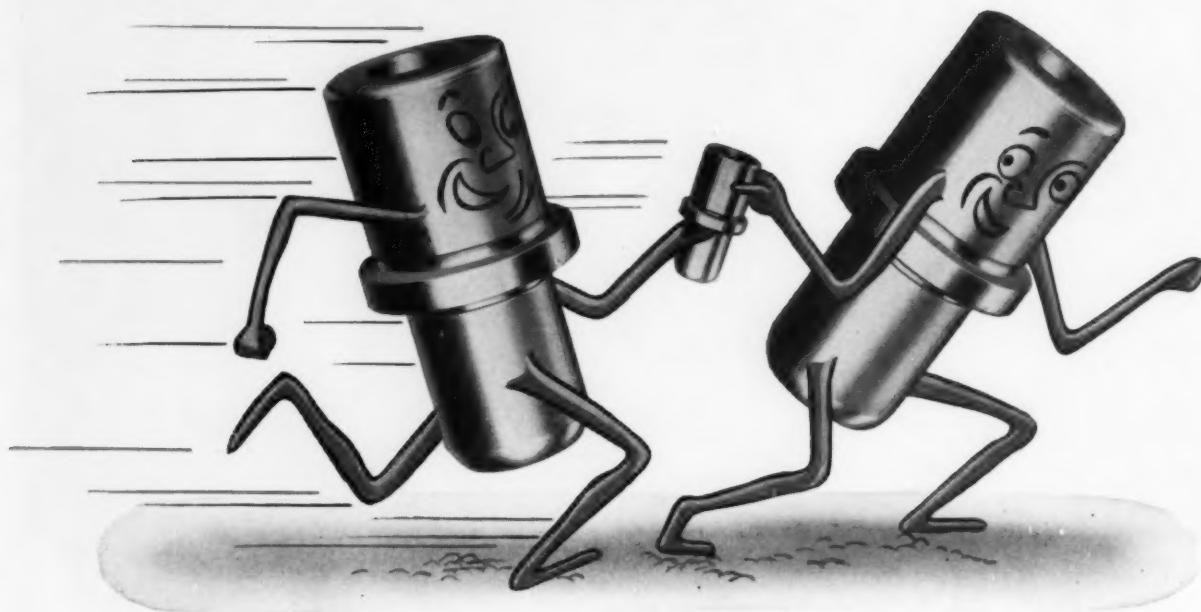
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Universal Flask Pins and Bushings of all types are available in a complete range of sizes as regular stock items. Plain, taper, threaded or hexagonal series. For complete information, write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 12, MICHIGAN

Talk of the Industry

IT'LL BE HOUSTON in 1955 . . . Dates selected for the 59th Annual Convention of American Foundrymen's Society in the Texas metropolis: May 23-27, inclusive. This will be first time the AFS meeting has gone to the Southwest. As details develop, they will be fully reported in AMERICAN FOUNDRYMAN.

REVIVED INTEREST in cast-weld construction has led Cooper Alloy Foundry Co., Hillside, N.J., to expand capacity to meet increased demand for ELC grade--extra low carbon--stainless steel, which can be welded without subsequent heat treatment. Competitive conditions with emphasis on cost cutting has highlighted cost advantages of cast-weld construction, particularly where the method eliminates machining of large, unwieldy structures.

PREREQUISITE FOR a good safety record with resultant improved morale, increased production efficiency, and low-cost compensation, is one word directed at the top man--YOU. If you, the head man of the organization constantly emphasize the need for safe operating practice, those under YOU will practice safety. Safety, like every endeavor involving the human factor, must be motivated. A lift from the top will be much more effective than a boost from the bottom, according to E. C. Hoenicke, foundry division manager of Eaton Mfg. Co.

OVERHEARD AT CLEVELAND . . . Exhibitor: "If only five per cent of the people who say they'll buy our product actually order, our time and money invested in the 1954 AFS Convention will be well spent."

JOB OPPORTUNITY often overlooked is male secretary to a foundry superintendent. It provides a unique chance to learn foundry practice from both the supervisory and the operations standpoints. AMERICAN FOUNDRYMAN will pass on qualifications of applicants to the foundry superintendent who recently disclosed his need for a male secretary interested in becoming a foundryman.

VOLUME OF ORDERS far beyond expectations resulted from the demonstrations staged in his booth at the 1954 AFS Convention and Show, according to a manufacturer of small tools and equipment. Exhibit brought out unusual interest in new processes and equipment among 15,000 foundrymen who visited the Public Auditorium during the week of May 8-14.

RADIOACTIVE IRON ORE has been used at Ford Motor Co. River Rouge plant to trace the flow of ore through the white-hot heart of a blast furnace. Seventy-six tons of radioactively "tagged" ores were used to determine feasibility of mixing into the charge fine iron powders obtained by concentrating low-grade ores. Amount of material actually smelted into iron, compared with that expelled and trapped in dust-collection system, was determined by checking radioactivity of the pig iron, slag, and expelled dust. Despite large amount of material involved, level of radioactivity was so slight that it was 100 times below the level prescribed for safety by the Atomic Energy Commission.

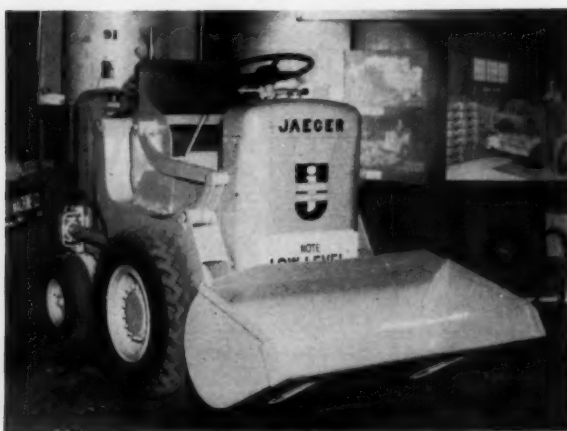
What's New in Foundry



Above—A. A. Hilbron, convention and exhibit manager, stops for chat with F. L. Moore, president, Peerless Mineral Products Co., Conneaut, Ohio, while taking C. E. Hoyt, retired executive vice-president and long-time manager of AFS exhibits, on deluxe tour of 1954 AFS Show.

Right—Fork lift truck rotates box to illustrate dumping.

Below—One of new front-end loaders exhibited this year.

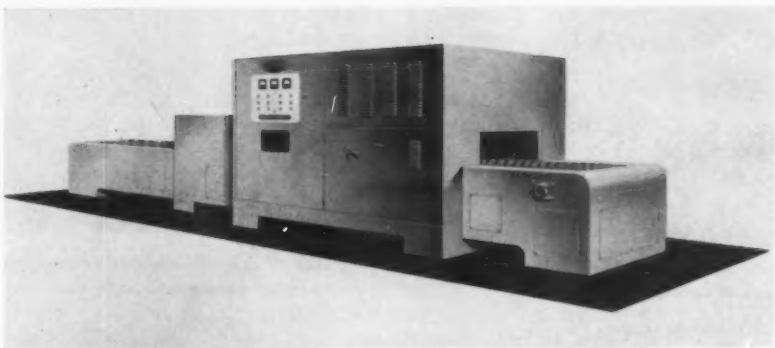


NEVER before the 1954 AFS Exhibit were so many new foundry products displayed for consideration as new tools for casting production. Exceeding previous Shows in number of exhibitors and space used, this year's Exhibit was also outstanding for the exceptional variety of new foundry equipment and materials not previously shown at an AFS Congress.

Eleven foundry experts studied this year's Show at the invitation of AMERICAN FOUNDRYMAN. Their report appears in this month's feature, "What's New in Foundry Equipment." The following observers participated: Lyle L. Clark, supervisor of foundry research, Armour Research Foundation, Chicago; Robert F. Dalton, project engineer, Hills-McCanna Co., Chicago; David E. Gilchrist, mechanical engineer, Deere & Co., Moline, Ill.; Wm. A. Hambley, service engineer, Chas. A. Krause Milling Co., Milwaukee; Prof. Richard W. Heine, University of Wisconsin; Wm. O. McFatridge, supervisor, foundry laboratories, Manufacturing Research, International Harvester Co.,



Equipment



Top—Shell blowing machine has two curing and stripping stations, produces two shells up to 24 x 30 in. every minute. Upper left—New mold conveyor operates well on level and grades. Left—Large, wide-belt dielectric oven handles more cores per foot. Above—Portable conveyor is gasoline-engine or electric motor powered.

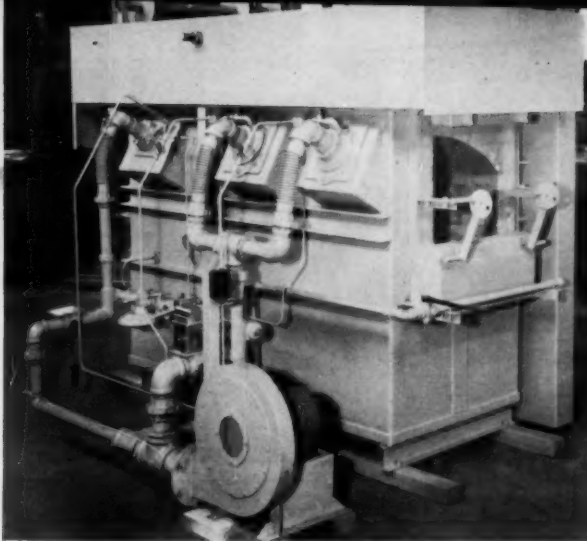


Front-end loader has high lift, good maneuverability.

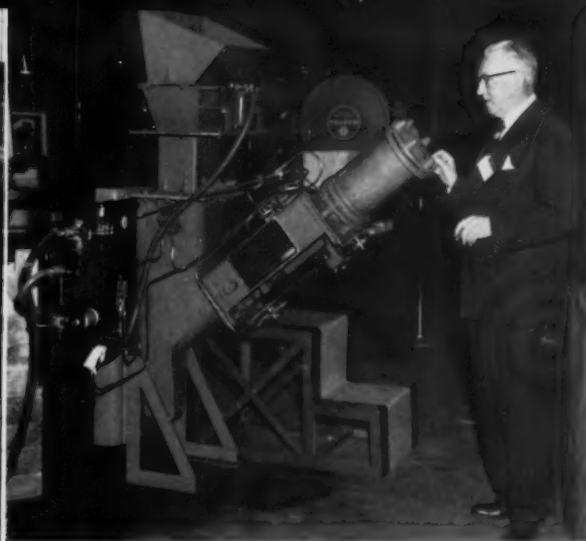
Chicago; Henry W. Meyer, general foreman, Sand Laboratory, General Steel Castings Corp., Granite City, Ill.; A. W. Pfeiffer, Pattern & Foundry Div., Allis-Chalmers Mfg. Co., West Allis, Wis.; Harold Rekart, plant engineer, National Malleable & Steel Castings Co., Cicero, Ill.; Frank B. Rote, manufacturing control manager, Albion Malleable Iron Co., Albion, Mich.; and Carl E. Rowe, president, Carl E. Rowe & Co., Milwaukee.

Materials Handling

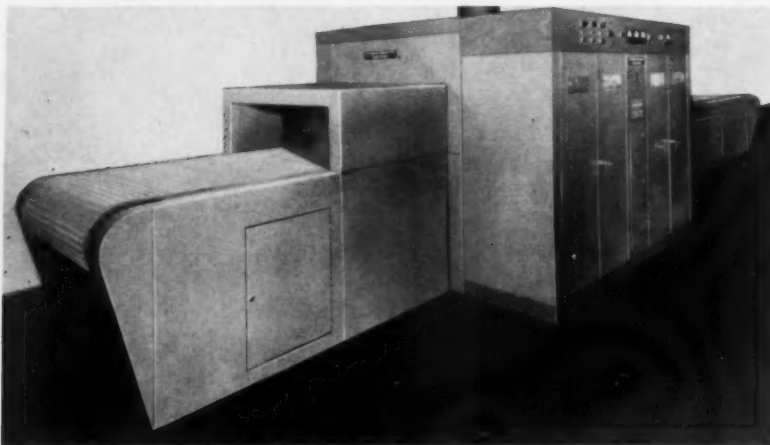
MORE AND MORE, successful foundry operation demands economical materials handling and the equipment manufacturers are constantly augmenting their lines and new suppliers are entering the field to aid the industry. This was amply illustrated at this year's AFS Congress where new material handling equipment ran



Dual furnace provides separate chambers for melting and holding, each individually heated and automatically controlled. Capacities of furnaces in series start at 350 lb per hr.



Pneumatic ram injects turnings and borings into cupola just above melting zone, simplifies machine shop scrap disposal, makes charge more economical, eliminates briquetting.



One of the newest dielectric ovens available is the latest addition to the well-known line of long-time supplier of traditional core baking equipment.



Powdered calcium carbide injected in molten iron desulphurizes it.

W. O. McFritridge



H. W. Meyer



R. W. Heine



L. L. Clark



D. E. Gilchrist



What's New Authors

W. A. Hambley



A. F. Pfeiffer



R. F. Dalton



F. B. Rote



C. E. Rowe



H. Rekart



heavily to front-end loaders with fork lift trucks and other handling devices also well represented.

A new flask-return conveyor was teamed with a rollover machine in one exhibit to show how the operator would be enabled to work on only one side of the machine.

A three-wheeled barrow capable of handling 1800 lb and reported to replace four standard barrows and three men was shown by a company which also exhibited a portable bulk material conveyor powered optionally by gasoline engine or electric motor.

Another equipment manufacturer exhibited a two-speed electric hoist for setting cores, drawing patterns, and parting flasks, as well as regular hoisting work. Also shown was an unusual lever-operated tool built like a hoist and suitable for pulling, holding, even hoisting, and a series of small, light-weight, one-man aluminum chain blocks with load capacities up to two tons.

A long-time producer of foundry equipment displayed a magnetic control device for overhead cranes that permits extremely sensitive hoisting or lowering of heavy or light loads.

Pallets, pallet boxes, dunnage, crates, and boxes for storing and shipping castings were shown by a wood supplier.

An all-hydraulic crane looked good for yard work, indoor work, and is available mounted on conventional truck or on a four-wheel, self-propelled, rubber-tired tractor.

New in overhead conveyors was a cable suspended from a monorail by means of load carriers. This equipment has a high degree of flexibility in installation and operation, with sharper dips and turns possible.

Novel adjunct to a British turn-over, jolt-squeeze machine is a gate-like section of roll conveyor that automatically swings up out of the way when the molding machine turns over, then resumes its position so the mold section can roll out of the machine onto the conveyor line.

Sand Conditioning & Handling

TWO AUTOMATIC MOISTURE control units for sand conditioning caught the eye of a number of Convention-goers, along with an operating exhibit of pneumatic sand reclamation, a European muller of



Above—Hydraulic crane features indoor-outdoor operation, is self-propelled or can be mounted on truck. Below left—Automatic moisture control for batch or continuous sand conditioning. Below right—Quick-response arc control speeds melting, saves electrodes and refractories.



Below left—High efficiency dust collector, part of complete line of air pollution control equipment for melting units can be used separately or with hot blast equipment.

Below center—Airless blast room with castings car handles unwieldy castings, has three abrasive hurling wheels.

Below right—New magnetic stock line indicator works like mine detector, helps control charge height in cupola.



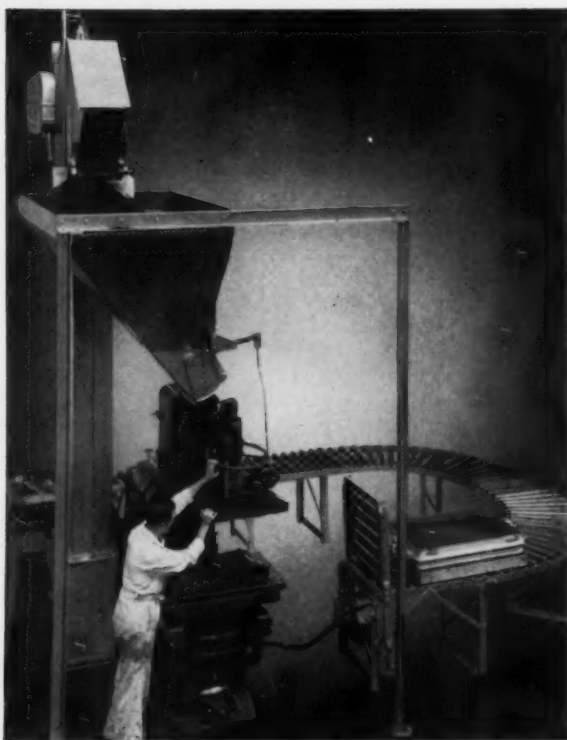


Above—Core rod straightener handles crooked rods rapidly and safely, distributes them in bins according to length.



Above—New large dielectric core oven handles more, larger cores per hour. Hourly capacity is 4250 lb resin bonded cores.

Below—Swing gate of roller conveyor in "up" position lets molding machine turn over for pattern withdrawal.



unique design, a floor-type sand conditioner with dump bucket, a mixer and an aerator either of which can be readily installed in an existing sand conveyor system, and new, larger elevator and double hopper unit able to handle up to 30 tons of sand an hour, and a muller on casters permitting use wherever needed in the shop.

Newcomer to foundrymen in the field of sand reclamation was a wet system for reclaiming shake-out sand, classifying it, and drying for return to the system. Usable on any type of sand, the system can reclaim and separate intermixed sands. Same company produces a water clarification system that can be coupled with a wet reclaimer.

Automatic compensation for temper water and evaporation requirements due to hot sand now available in the equipment of two suppliers is putting tempering and moisture control into mechanical rather than human hands. Supplementing these units are devices for automatically measuring and adding predetermined quantities of bond and additives.

The European muller supplied by an American firm features a rotating pan, three wide, spring-loaded mulling wheels, and a large number of ploughs and diverters. Designed for continuous conditioning, the muller gradually works the sand toward the center of the pan where it passes through an orifice into the conveying system.

Moving core and molding sand by air, given considerable impetus by appearance of a unit at the 1950 and 1952 AFS Exhibits, should receive another boost from display at this year's Convention of two new units, one designated as a pneumatic sand conveyor, the other as fluidized feeding of solids.

Green Sand Molding

THREE DIFFERENT mold blowing machines, a flaskless squeeze machine, an automatic indexing jolt-squeeze-strip machine, twin equipment that makes a cope and drag simultaneously, a diaphragm-squeeze unit, a pin-lift machine that jolts and squeezes simultaneously, a slinger, a fire-resistant bottom board, aluminum bottom boards and jackets, and aluminum tight flasks were among the items in the field of green sand molding that were not seen at previous AFS Exhibits.

New developments in blowing and squeezing green sand have raised production of a mold blower to as high as four complete molds per minute. Automatic operation using high squeeze pressures produces castings with excellent surface finish and close tolerances.

A high speed molding machine which produces a complete mold without any flask (needs only bottom boards and jackets) offers the squeezer-type shop fast operation. A two-sided matchplate is used.

The automatic, two-station indexing machine (can also be operated manually) distributes molding operations between two stations which operate simultaneously. Equipment strikes off, jolts, squeezes, and strips, discharging completed mold sections onto run-out conveyor.

High pressure squeezing of high flowability sands by means of an elastic diaphragm that follows the pattern contour was demonstrated by one manufac-



Exhibit features carbon-bonded crucible for non-ferrous work.

turer. Objective of equipment is to produce hard, uniformly dense molds for production of precision castings.

A twin molding machine for simultaneous production of a cope and drag by jolting and squeezing rotates both mold sections 180 degrees for pattern drawing.

A new flask-lift machine was shown that jolts and squeezes simultaneously and was reported to require only 10 to 15 seconds from rolling on a flask to striking off the finished mold section.

Slinger-type equipment new to American foundrymen (British patent) rams sand by means of a rotating, two-bladed impeller head to give high mold hardnesses and an output of up to 800 lb of sand per minute.

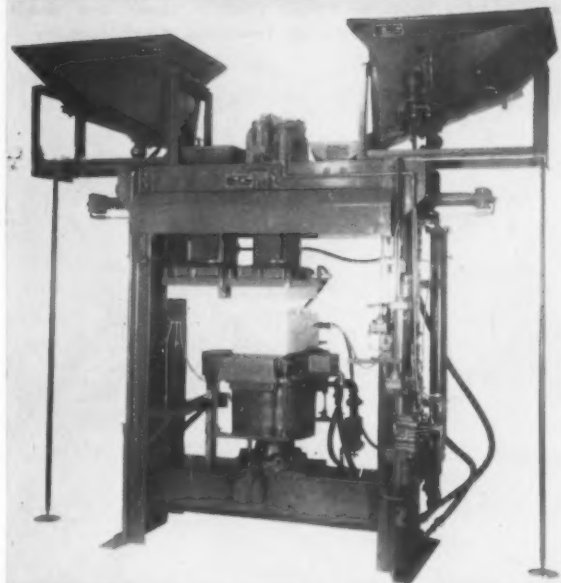
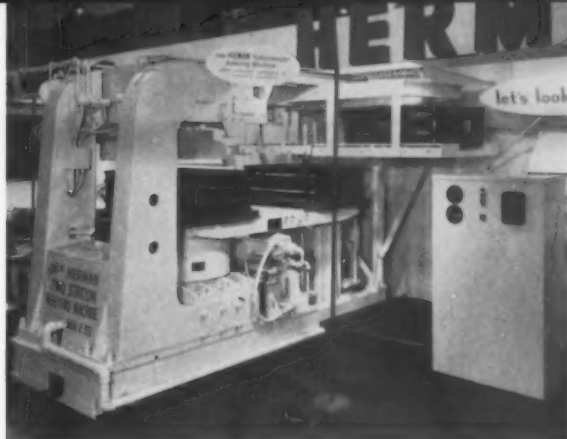
The fire-resistant bottom board has a glued-block center core faced on both sides with a resin and sawdust mixture that is 50 per cent harder than hardwoods and will still be usable after direct contact with molten metal at 2900 F.

Cast aluminum bottom boards and aluminum jackets were displayed by one manufacturer. Flexibility of corner joints on the jackets makes them crush proof, shift proof, and shave proof.

New in tight flasks is an extruded aluminum flask that is especially light in weight though usable for heavy molding.

Coremaking

LARGER DIELECTRIC OVENS (cores up to 48 in. wide, capacity 4250 lb per hr) were featured by two exhibitors this year, a redesigned dielectric series that can be assembled like "building blocks" to make larger units was shown, and a new entry in the dielectric field was displayed by a manufacturer prominent in core baking equipment for a number of years. Three manufacturers offered double-headed core blowers which give up to 400 blows an hour and can be used, if desired, with two different core boxes and two different sand mixes. Also shown was a blower with a special slotted-sleeve magazine making possible blow-



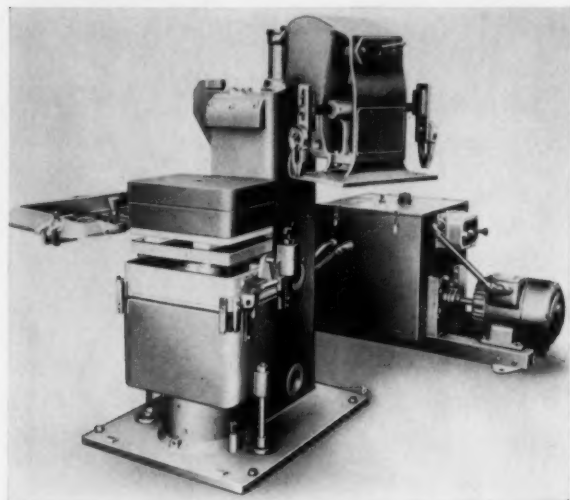
Top—Indexing machine divides jolt-squeeze-strip operations between two stations which operate simultaneously. While one flask receives sand, jolts, and squeeze, other is stripped and run out on conveyor to make room for empty flask.

Middle—Twin-magazine core blower can use two different boxes and/or mixes. One magazine fills while other blows.

Bottom—Calcium carbide injection unit for desulphurizing or pretreatment of nodular iron upgrades molten gray iron.



Above—Shake-out unit for squeezer line dumps molds, returns pallet and bottom boards via lower rail. Below—Flaskless squeeze machine makes shallow cores and drags, squeezing simultaneously on two-sided matchplate.



ing of extremely stiff core mixes and molding sand.

Rod straightening and sorting can be done swiftly and safely by means of a newly-marketed device. Rods $\frac{1}{4}$ - $\frac{3}{4}$ in. in diameter are drawn through the dies by means of rubber rollers which lose their grip in case anything resists movement of the rod. Operator's fingers are completely safe. Straightened rods 10 to 36 in. are automatically sorted and distributed in bins ready for re-use. Device will handle rods up to 50 in. long.

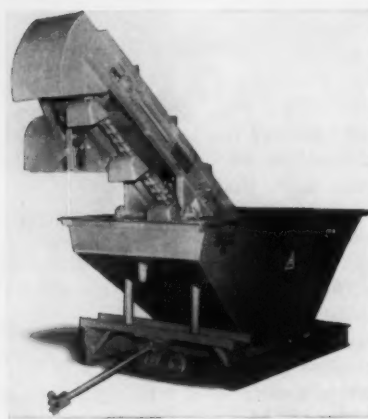
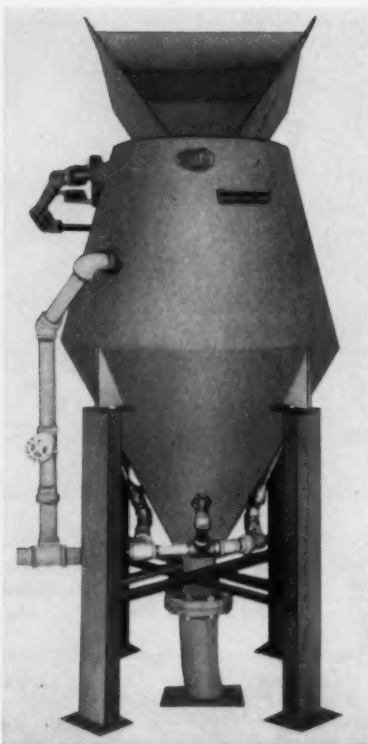
A rotary core grinder, with telescoping shroud to prevent scattering of sand, which can be attached to existing dust system or supplied with attached arrestor, blow box sealers displayed by two exhibitors, and a liquid resin for cold coating of sand for shell molding or for large cores, were also shown for the first time. One of the blow box sealer companies supplies not only synthetic rubber and plastic seals but also seals of low melting alloy. The other exhibited abrasion-resistant blow buttons, core and mold blowing tubes, and sealer tubing.

A supplier well-known for blowing equipment that permits use of wooden boxes exhibited for the first time a blow plate that can be used for extremely short runs on wooden boxes since changeover time from one box to another is approximately a minute.

Metals, Fluxes, Refractories

CARBIDE INJECTION EQUIPMENT and processes displayed by two companies offered foundrymen a means of desulphurizing gray iron in the ladle, of up-grading properties, and of pre-treating nodular iron. Units available provide for nitrogen injection of finely-divided calcium carbide through a refractory tube.

Continued on page 104



Far left—Sand chamber for new pneumatic distribution system.

Left upper—Fork truck handling of palletized agricultural implement castings. Truck was exhibited.

Left lower—Portable, wet slag disposal unit requires no special installation.

Above—Familiar floor-type sand conditioner appeared for first time at 1954 AFS Convention with bucket for accumulating and unloading sand.



J. C. Pangborn

T. W. Pangborn



Brothers Create \$55,000 Pangborn Award and Scholarship Program

■ Enduring confidence in the future and continued recognition of need for freedom of opportunity have been expressed by Thomas W. and John C. Pangborn, president and vice-president of Pangborn Corp., Hagerstown, Md., through a \$50,000 grant to the American Foundrymen's Society. Intended for educational purposes, the grant is made in the 50th anniversary year of the company the brothers founded in 1904. Object is to establish a fund to provide scholarships which will be administered locally by chapters of AFS.

The grant closely parallels the objectives of the recently launched AFS Educational Program, concentrated at the secondary school level. The new program is expected to augment the work of the Foundry Educational Foundation which has, since its establishment in 1947, significantly expanded the interest of engineering colleges in the problems of foundry management.

Original announcement of the grant was made during the banquet of the 1954 Convention of AFS. On that occasion, AFS President Collins L. Carter cited the Pangborns' continued interest in the foundry industry's well being and future growth, and pointed out that Pangborn Corp. had set up the first operating foundry exhibit in America and had exhibited in every foundry show since the first held in 1906.

An additional \$5000 has been made available to AFS for establishing an award similar to those already in existence and administered by the Society. These awards, presented from time to time at annual meetings of AFS commemorate the services to the castings industry of such men as: Joseph S. Seaman, third president of AFS; John A. Penton, first secretary; Wm. H. McFadden, 10th president; John H. Whiting, 1906 vice-president; and Peter L. Simpson, pioneer foundryman and equipment manufacturer.



In jovial mood as they discuss the Pangborn grant at the Alumni Dinner during the 1954 AFS Convention are, left to right: V. F. Stine, Pangborn Corp.; T. W. Pangborn; Walton L. Woody, National Malleable & Steel Castings Co.; an AFS past president; Collins L. Carter, Albion Malleable Iron Co., retiring president; and Frank J. Dost, Sterling Foundry Co., new president of AFS.

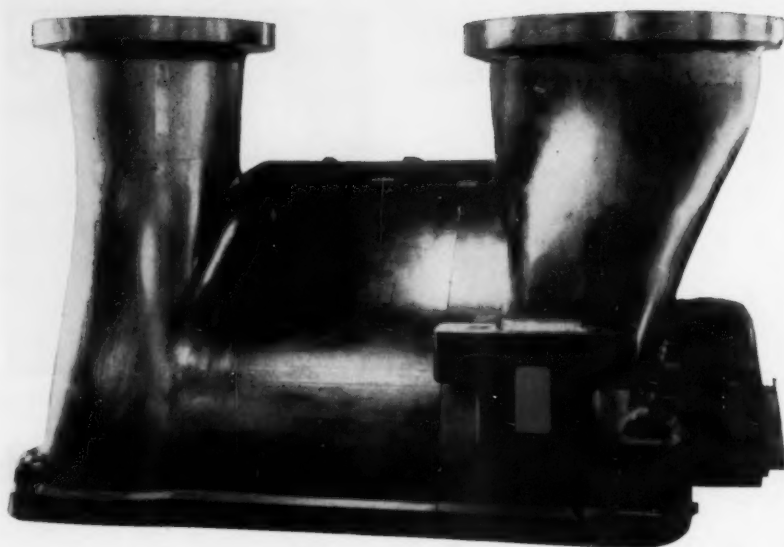


Fig. 1—Pattern for centrifugal compressor casting designed for molding with drawbacks and cement-bond sand.

Drawback Method of Producing Large Compressor Castings



CHARLES W. FRAME, JR.
Fdry. Eng., Chambersburg Engineering Co.,
Chambersburg, Pa.

A surveyor's level is standard equipment in few foundries, but you need one when you're making large castings like a 21,000-lb centrifugal compressor casting.

■ Casting buyers are increasingly aware that they have a broad responsibility which cannot be fulfilled simply by purchasing castings from the lowest bidder. They recognize more and more that castings are an integral part of their finished product and therefore quality must begin with the foundry.

They are also learning that the cheapest rough casting is frequently the most expensive finished part. Excessive variations from design dimensions result in extra machining costs, production delays, and even special engineering to make the casting usable. Only part of these extra costs can be accurately measured.

Chambersburg Engineering Co. specializes in large cast iron and ductile iron castings of maximum dimensional accuracy and soundness and with specified physical properties. They employ cement-bonded sand as

the principal molding and core making material because of its high strength and freedom from distortion. Certain small cores are made using an oil-bonded sand. Their foundry engineering staff endeavors to work with the customer from the design stage through to the finished casting. Their metal is metallurgically controlled, and their inspection department checks every stage of the casting production to insure that errors are eliminated before the casting is poured. This foundry engineering and control results in reduced cost of the finished castings with all the inherent advantages to the customer.

Drawback Method Selected

The centrifugal compressor case illustrated in Fig. 1 is an example of what careful foundry engineering and controls can achieve. It can be noted that the design is complex and offers many problems. This job could be molded in at least three ways. Chambersburg's engineers selected the drawback method over either the

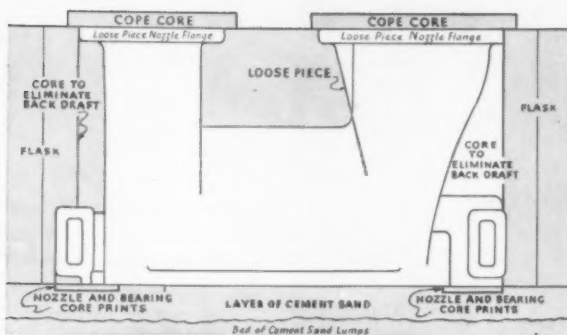


Fig. 2—Pattern cost for this conventional roll-over method would be reasonable, special flask expensive.

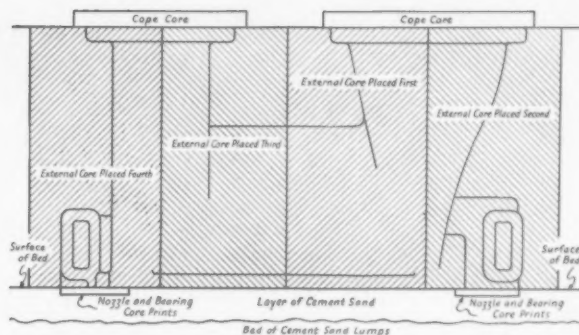


Fig. 3—Using external cores, this casting would need large, heavy pattern equipment of prohibitive cost.



Fig. 4 (left)—Surveyor's level is used to insure accurate foundation in laying of cement-bonded sand bed.

Fig. 5 (below)—Frame with drag core prints dowelled in place is set on top of the level sand bed.

external core method or the conventional roll-over method illustrated in Figs. 2 and 3. This method, which has proven in practice to give maximum accuracy with minimum pattern and flask equipment and reasonable production costs, is described by this article.

The drawback method of molding used is particularly adapted to cement-bonded sand because of its high strength and chemical hardening properties. Chambersburg's sand mixture consists of 83 per cent silica sand, 10.5 per cent high-early-strength cement and 6.5 per cent water. The silica sand is composed of 50 per cent reclaimed and 50 per cent new. This material mixed in muller-type equipment, develops its high strength through chemical action between the water and cement in 24 to 36 hr. However the sand must dry for 72 hr before pouring. The moisture content is checked with an electric hygrometer which is highly sensitive to moisture changes especially developed for the company.

Surveyed for Accuracy

After digging a pit, the first operation is the laying of a cement-bonded sand bed over a 3-in. layer of foam slag venting material, using straight edges placed parallel and gauged with a surveyor's level to insure an accurate foundation (Fig. 4). A wooden frame, upon which the drag core prints are positioned and held with dowels (Fig. 5), is then set on top of the level bed and a layer of sand is rammed around the prints and over the rest of the bed. The frame is then removed

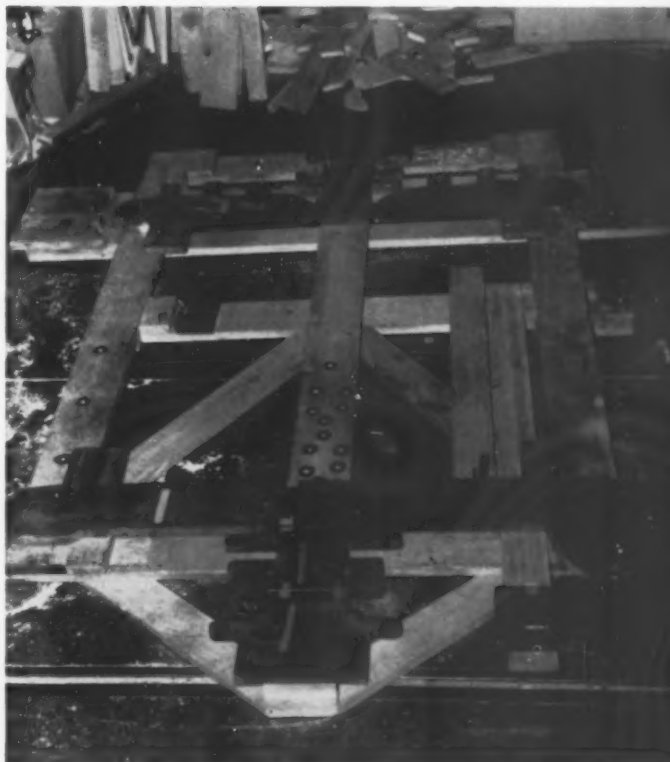




Fig. 6 — Striking-off bed level with drag core prints. Prints are then removed and cement-bonded sand allowed to harden.



Fig. 7—Lowering pattern. Dowelled core prints locate pattern accurately. Drawbacks are made next.



Fig. 8—Drawbacks curing against pattern. After sufficient hardening, cheek flask is set.



Fig. 9 (above)—Construction of main core by means of core box sections and sweep. Box is assembled on mold drag and, after accurate positioning and checking for alignment, is blocked with weights to prevent movement.

leaving the core prints in place and the bed is struck off level with the top surface of the core prints (Fig. 6).

The prints are then removed and the cement-bonded sand allowed to harden. This sand will harden sufficiently over night to allow walking over and working on top of it the following morning. The following day after checking the bed with a surveyor's level, the bearing prints are replaced in their respective positions in the bed and the pattern is lowered onto the metal dowels in the prints, insuring its accurate placement as illustrated in Fig. 7.

The next step is the making of the drawbacks. These are made against the pattern in all places that would prevent the pattern from drawing. These drawbacks accurately conform to the contour of the pattern, but do not require accuracy on surfaces away from the pattern. These surfaces are rammed against any convenient form such as boards or metal plates. At Chambersburg, sheets of paper are used to separate the drawbacks during the ramming and curing periods but soapstone or any similar parting compound can be utilized.

Experience along with a careful study of the particular job will dictate the size and number of drawbacks. Metal bushings are rammed into the sand bed and also into the drawbacks and they together with matchpins insure accurate placement of the drawbacks during mold assembly. No cinders or other venting material need be incorporated in the drawbacks as the cement-bonded sand mixture allows the gases to permeate through the drawbacks to the very coarse back-up material consisting of 88.5 per cent reclaimed sand, 5 per cent cement, 6.5 per cent water. Figure 8 shows the drawbacks still against the pattern while they are curing.

After the drawbacks have hardened sufficiently, a cheek flash is placed on them. This is simply a frame

Fig. 10 (below)—Mold begins to take final shape. Metal bushings and drawpins are used in placing drawbacks.





Fig. 11—Drawbacks are in position and mold is almost ready for closing operation.

with one tie rod through the middle. No bars or arbors are needed because of the strength of cement-bonded sands. As soon as the flask is rammed the loose piece flanges are drawn as well as the top section of the discharge pipe and the discharge side of the intake pipe. The cheek is then allowed to harden.

The following day the cheek can be lifted, the drawbacks removed, and the pattern taken out of the mold. All parts of the mold face are coated with blackening wash and allowed to dry thoroughly in air.

Main Core Box

The main core box which forms the center core of the casting is illustrated in Fig. 9. This box consists of two semi-circular end pieces, three stationary segments, one movable segment, and a sweep. The box is assembled on the drag of the mold, accurately positioned in relation to the drag core prints, and, after being checked for alignment and square, it is blocked with weights to guard against any movement of the box or change in shape.

Because the center core is rammed in place, eliminating any moving or rolling, the core can be filled with approximately 75 per cent foam slag and no rods or arbors need to be used for reinforcement. The radial surface of the core is formed by shifting the movable segment up each side in steps until all but six inches of the surface is rammed, this last section being formed with a sweep. Core is vented through the drag.

Since the center core is rammed in place and never handled there is no settlement or distortion and maximum accuracy results. The elimination of all rods and arbors allows most of the center core to fall out when the casting is lifted.

The intake and discharge pipe cores are not parted. The boxes are constructed with loose pieces to permit easy stripping of the box. These cores are rammed of cement-bonded sand and allowed to harden in the core boxes so that no distortion occurs. The smaller cores,



Fig. 12—Lowering the cheek flask onto the drawbacks. Flat cement sand slabs are then placed over cope.

such as the bearing cores and the oil pocket cores are produced in conventional dump-out core boxes, using oil-bonded sand.

All cores and components are given a thorough wash with a coke-base blackening and allowed to air dry before assembly is started. This blackening wash produces a clean, smooth surface finish on the casting.

Accurate assembly is vital in the production of all good castings because no matter how carefully cores and molds are built, variations will occur. The incorporation of matchpins and bushings largely facilitates the assembly operation. However, inspection is the key to this operation and every step must be closely checked for accurate dimensions of metal sections and correct locations and alignment of cores.

The center core being built in place, the first cores positioned are the bearing and lightening cores at each end of the mold. These cores as well as the pipe cores are set in the prints on the sand bed shown in Fig. 6. Then the drawbacks are placed using the metal bushings and drawpins (Fig. 10 and 11). Next the rammed up cheek flask is lowered (Fig. 12), followed by the placement of flat slabs of cement sand over each nozzle forming the cope.

Inspector Checks Mold

Before each section of the mold is closed, the foundry inspector checks all metal sections and critical dimensions. This inspection together with the fact that the drawbacks are built together and against one another and placed in position with matchpins and bushings amounts to a double check which means that incorrect alignment of cores is next to impossible.

Through this drawback method—which utilizes a center core built in position, and one-piece pipe cores, as well as the drawbacks themselves—all sagging and distortion is eliminated. This results in a top quality casting requiring a minimum of machining expense and a reasonable foundry cost.

Medium manganese steels containing 0.10 per cent vanadium were found to be equivalent in mechanical properties and hardenability to those containing 0.30 per cent molybdenum for the production conditions reported.

■ Medium manganese cast steels exhibiting excellent strength and ductility at medium carbon levels have been produced in large tonnages for many years. These steels are usually made in the range of 1.00–1.60 per cent manganese and 0.20–0.50 per cent carbon. They frequently contain an additional alloying element such as molybdenum, vanadium, or chromium, and such combinations as manganese-molybdenum and manganese-vanadium have found wide acceptance in the steel castings industry.



C. C. Spencer

In the following pages, the author reports on test work designed to obtain comparative data on physical

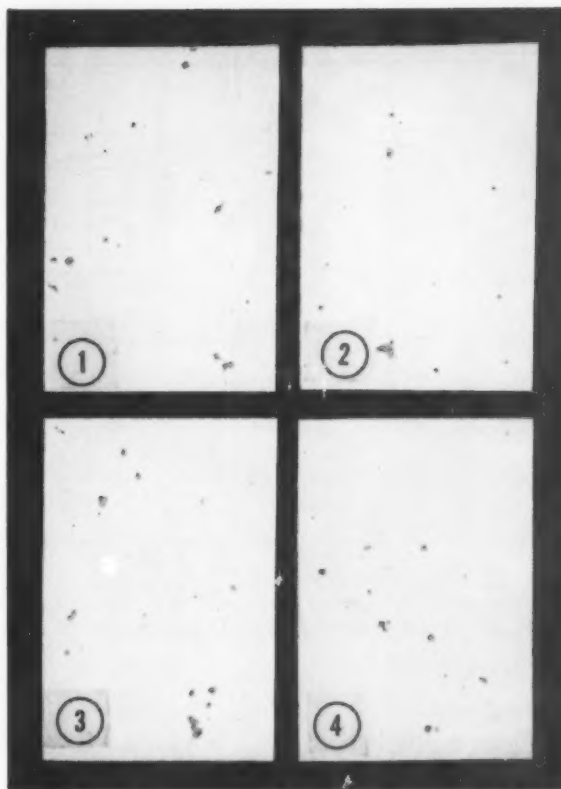


Fig. 1—Inclusions are irregular sulphides, some duplex. All photomicrographs 250X, unetched. Figures appearing on photographs indicate ladle numbers.

Vanadium and Molybdenum in Medium Manganese Cast Steel

CHARLES C. SPENCER / Melting Supt., Electric Steel Castings Co., Indianapolis Ind.

properties of medium manganese, manganese-vanadium, and manganese-molybdenum cast steels. As a result of this work, it is concluded that in steels of medium manganese type examined, and in the particular conditions of heat treatment represented, the manganese-vanadium steels containing 0.10 per cent vanadium were equivalent to the manganese-molybdenum steels containing 0.30 per cent molybdenum with regard to mechanical properties and hardenability.

Experimental Procedure. To obtain the physical property data desired on medium manganese, manganese-molybdenum, and manganese-vanadium steel castings, a series of keel block ends were cast. In order to obtain an accurate comparison the three analyses cast were made from the same heat of steel,

by means of ladle additions of vanadium and molybdenum to a medium manganese heat.

The regular melting practice of Electric Steel Castings Co. was followed in the production of the heat in which the keel block ends were cast. The heat was melted in a 5-ton, 2500-kva acid-lined furnace. The charge consisted of 40 per cent shop returns and 60 per cent carbon scrap. Normal melting practice involves oxidation of the heats with the use of both iron ore and oxygen. Carbon is reduced to about 0.12 per cent carbon and the heat is recarburized with pig iron followed by a furnace addition of silicomanganese and ferromanganese immediately prior to tap. Ladle deoxidation practice consists of the addition of 1 lb aluminum plus 5 lb calcium-manganese-silicon per ton in the tapping ladle, and additions of 1½ lb

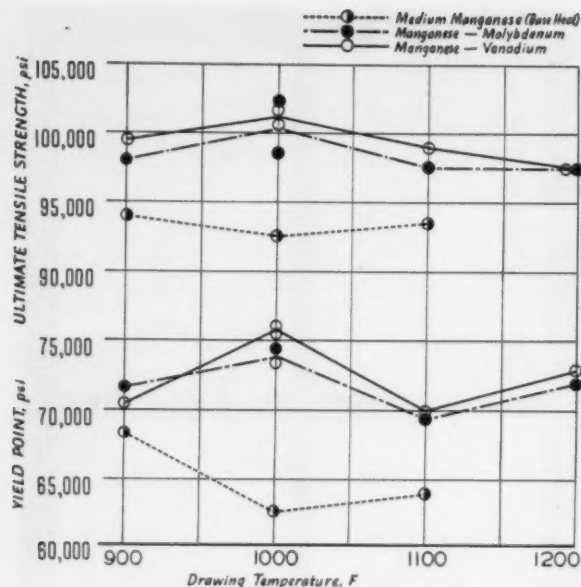


Fig. 2—Yield point and ultimate tensile strength.

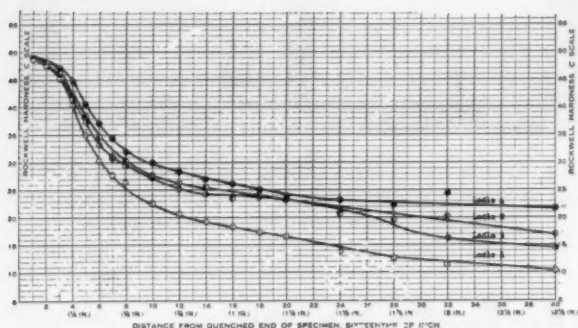


Fig. 3—Jominy hardenability curves for ladles 1-4.

aluminum plus 2 lb calcium-silicon per ton in the shank ladles. The heat log for the experimental heat described gives melting details.

Keel blocks were poured from each of four 375-lb shank ladles from the same heat, ladle additions being made as follows: (1) Normal shank ladle—aluminum and calcium-silicon additions only; (2) Vanadium addition plus normal aluminum and calcium-silicon additions; (3) Molybdenum addition plus normal aluminum and calcium-silicon additions; and (4) Vanadium and normal aluminum and calcium-silicon additions plus a small addition of iron ore.

Details of the ladle additions are tabulated in Table 1. The iron ore addition to ladle 4 was made to study the effect, if any, of this addition on the ductility of the steel. All shank ladle additions were introduced from a sheet-metal chute into the metal stream from the teapot ladle. Four keel blocks were poured on each of these four ladles and analysis, hardenability data, and physical properties were obtained.

Chemical analyses of the samples are shown in Table 2. These indicate that good recovery was obtained with all of the ladle additions. The original aim was a vanadium content of approximately 0.10

TABLE 1—SHANK LADLE ADDITIONS

	Ladle 1 (Normal)	Ladle 2 (Vanadium)	Ladle 3 (Molybdenum)	Ladle 4 (V plus ore)
Aluminum, lb	0.35	0.35	0.35	0.35
Calcium Silicon, lb	0.32	0.32	0.32	0.32
Ferrovandium (55% V), lb	—	0.71	—	0.71
Ferromolybdenum (60% Mo), lb	—	—	1.60	—
Ore	—	—	—	0.19

TABLE 2—CHEMICAL ANALYSIS

	% C	% Mn	% P	% S	% Si	% Mo	% V
Keel block 1	0.26	1.29	0.024	0.036	0.48	—	—
" " 2	0.24	1.26	0.027	0.038	0.49	0.04	0.11
" " 3	0.27	1.24	0.025	0.036	0.51	0.31	0.008
" " 4	0.22	1.21	0.025	0.036	0.51	0.04	0.11

per cent in ladles 2 and 4 and a molybdenum content of 0.25 to 0.30 per cent in ladle 3.

Metallographic examination of samples from bars of each of the four compositions indicated the predominant inclusion type to be irregular sulphides with occasional duplex sulphides as shown in Fig. 1. No significant differences in type or quality of inclusions were observed among the specimens.

Mechanical Tests. Representative bars of the four steels were normalized and water quenched from 1650 F and drawn at temperatures from 900 F to 1200 F. Upon testing, the results shown in Table 3 were obtained. It will be noted that the addition of 0.11 per cent vanadium to cast steel of the medium-manganese type resulted in tensile and impact properties in the normalized and drawn condition similar to those obtained with the addition of 0.31 per cent molybdenum. After quenching and drawing, the vanadium treated steel appeared slightly superior. The addition of iron ore to the vanadium-treated ladle resulted in some loss of ductility in the tensile test of the normalized and drawn specimen. This lower ductility was reflected in the appearance of a fracture, which was "irregular" as compared to at least a "half cup" in all other tests. On the other hand, the impact resistance of this steel was considerably increased. In the quenched and drawn condition the differences were not so noticeable. Yield and tensile strength values for the normalized and drawn steels are plotted against drawing temperature in Fig. 2.

Hardenability Tests. Standard Jominy hardenability tests were carried out on samples from the bars from each of the four ladles (Fig. 3). It will be noted that the addition of 0.11 per cent vanadium increases the hardenability, particularly the non-martensite hardenability, to a degree at least equivalent to that produced by 0.31 per cent molybdenum. The iron oxide addition to the vanadium treated steel resulted in an even greater increase, however, as noted in the paragraph above, the mechanical properties of the latter steel were somewhat inferior.

Acknowledgment. The author wishes to thank the Electro Metallurgical Co. for assistance in obtaining the mechanical properties and hardenability data, and in preparation of photomicrographs. He also acknowledges the cooperation of Fred Kurtz and Steven Taylor of Electric Steel Castings Co. in the preparation of this paper.

Heat 7756 Electric Steel Castings Co. Indianapolis
5 Ton Furnace—2500 KVA Acid Lining March 23, 1951

Charge: Gates and Risers 3200 lb
Carbon Scrap 5000 lb
8200 lb

Normal charge is 10,200 lb. Small charge due to special analysis not being needed in full quantity.

Time

7:41 am (Power On) 3000 kva, 235 volts
8:10 am Pushed in some scrap with oxygen lance
8:15 am All scrap under slag; 175 volts
8:15-8:20 am 180 lb iron ore
8:27 am Oxygen: $\frac{3}{8}$ -in. lance, 65 psi, 2 min
8:29 am 25 lb limestone; 135 volts
8:30 am Carbon (judged on refractory wheel) 0.10-0.11 per cent
8:35 am 200 lb pig iron
8:45 am Carbon judged to be 0.18 per cent
8:46 am 40 lb pig iron
8:47 am 64 lb silicomanganese
52 lb standard ferromanganese
8:50 am Cup fluidity test, 41 sec
8:50 am Slag test { SiO_2 FeO MnO CaO Al_2O_3
53.76 25.15 12.98 3.38 3.60
8:51 am Tap. Additions made to teapot tapping ladle: 110 lb standard ferromanganese, 20 lb calcium-manganese-silicon, 4 lb aluminum



Fig. 4—Hydraulic pump jack housings made of medium manganese-vanadium steel require ductility and high tensile strength. Test bars of this steel were normalized and water quenched before testing. In addition, standard Jominy hardenability tests were made on bar samples taken from each of four ladles.

TABLE 3—PHYSICAL PROPERTIES AFTER HEAT TREATMENT

Specimen	Type	Heat-Treatment (1)	Yield Point, psi	Ultimate Strength, psi	% El. in 2 in.	% RA	Izod ² ft-lb (2)
1 QD	Med. Mn	Q, 1650F; D, 1000F	100,000	121,500	16.0	38.8	49.5
1 N	Med. Mn	N, 1650F	66,000	93,500	20.0	36.6	—
1 N (Ck.)	Med. Mn	N, 1650F	65,000	93,500	25.0	42.5	—
1 ND1	Med. Mn	N, 1650F; D, 900F	68,500	94,000	27.0	51.7	—
1 ND	Med. Mn	N, 1650F; D, 1000F	62,500	92,500	28.0	51.4	37.5
1 ND3	Med. Mn	N, 1650F; D, 1100F	64,000	93,500	27.5	51.9	—
2 QD	Mn-V	Q, 1650F; D, 1000F	126,000	143,000	18.0	31.5	35.5
2 ND1	Mn-V	N, 1650F; D, 900F	70,500	99,500	25.0	48.4	—
2 ND	Mn-V	N, 1650F; D, 1000F	76,000	100,500	25.0	50.3	22.0
2 ND2	Mn-V	N, 1650F; D, 1000F	75,500	101,500	21.0	49.8	—
2 ND3	Mn-V	N, 1650F; D, 1100F	70,000	99,000	24.0	46.9	—
2 ND4	Mn-V	N, 1650F; D, 1200F	73,000	97,500	25.5	49.2	—
3 QD	Mn-Mo	Q, 1650F; D, 1000F	118,000	137,500	10.5	29.8	33.5
3 ND1	Mn-Mo	N, 1650F; D, 900F	72,000	98,000	25.5	48.1	—
3 ND	Mn-Mo	N, 1650F; D, 1000F	73,500	98,500	26.0	50.6	22.0
3 ND2	Mn-Mo	N, 1650F; D, 1000F	74,500	102,000	21.0	47.5	—
3 ND3	Mn-Mo	N, 1650F; D, 1100F	69,500	97,500	25.0	50.6	—
3 ND4	Mn-Mo	N, 1650F; D, 1200F	72,000	97,500	25.0	46.3	—
4 QD	Mn-V(+ore)	Q, 1650F; D, 1000F	125,000	145,500	13.0	36.3	34.0
4 ND	Mn-V(+ore)	N, 1650F; D, 1000F	76,000	106,500	17.5	41.9	32.0

(1) N = Normalized; Q = Quenched; D = Drawn.

(2) Average of two tests.

Slurry System Improves Sand, Reduces Binder Consumption

How a binder dispersing unit speeds sand mixing, eliminates dust, and gives better properties with less binder is described in this article prepared by Pontiac Motor Div., GMC, foundry staff members. G. C. Collingwood is superintendent of the foundry.

■ In January 1949, the Pontiac Motor Div. of General Motors Corp. began a study of the slurry, or wet method, of handling bonding clays for system sands. The purpose was to determine whether a slurry could be used at Pontiac and to compare the costs and effects with the existing dry clay method. At the time the study began, clays were being trucked to the sand systems and lifted by bucket elevator to storage bins over the sand mixers, then fed into the mixers by vibrating feeders with the feed intervals controlled by

electric timers, as a means of measurement. Such clay additions were not reliable, mainly because the rate of flow varied greatly with the moisture content and the amount of entrapped air in the clay. In addition, the timers gave some trouble due to dust, etc.

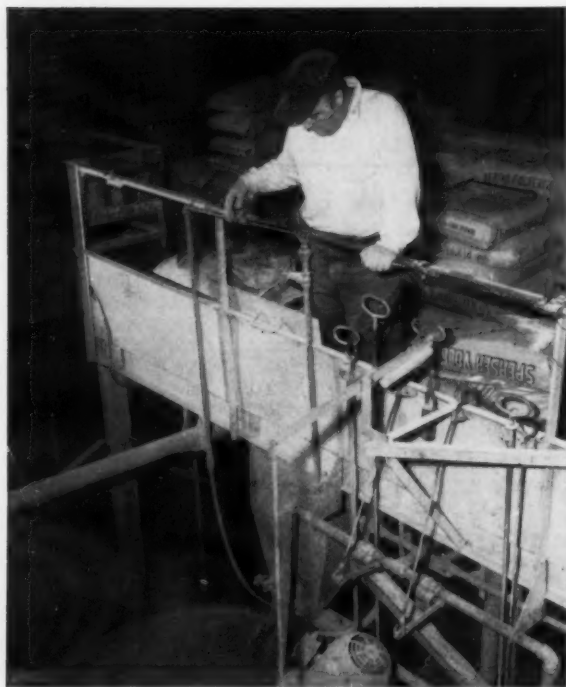
The use of a slurry offered a means of accurate clay measurement. It also gave promise of reducing dust in the sand mixing areas and of eliminating clay losses into the dust collecting systems. Finally, the introduction of pre-divided and perfectly dispersed clays into the sand mixers, indicated a favorable effect upon the quality of the sand produced. This effect was highly desirable, as the normal demands of the molding lines required the mixers to produce to the extent of sacrificing quality for quantity.

Preliminary tests revealed that the water replacements required in all molding sands were ample to serve as the vehicle for carrying the necessary clay additions, and without producing excessive viscosity. It was also determined that the suspending properties of the clays then in use were sufficient to minimize settling and resultant clogging with a normal flow of the slurry. In addition, these clays could be wet and dispersed with a practical amount of agitation.

In April 1949, temporary equipment to supply slurry was provided for one sand system. This equipment consisted of a V-shaped hopper or dispersing unit (to be described later) mounted over a 55-gal drum and involved an expense of not over \$50. The slurry produced by this equipment was measured by volume and manually poured into the mixers.

After approximately two months trial, it was concluded that a complete conversion to the slurry method could be made without creating any obstacles to production, and that sand workability and the quality of castings should be improved. In addition, there was an indicated savings in clay consumed approximating 30 per cent on the molding lines served by the temporary equipment.

In planning the installation of the master slurry mixing system, which the study indicated as being feasible, considerable thought was given to the problem of possible settling in the line, particularly over week ends. To preclude such a possibility, it was finally decided to recirculate the slurry. This gave an opportunity to flush out the lines with water at the end of



Dry clay is dispersed into slurry-making tank through V-shaped hopper with sheet of water directed through falling clay to insure proper wetting action.

the shift, returning this water to the mixing tank, ready for the addition of clays the following morning.

The master slurry system to service all lines was installed and in use by January 1950. It has made a definite contribution toward: (1) Better control of molding sands, (2) An improvement in the quality of molding sands, (3) A savings in the cost of bonding clays, (4) Better housekeeping, and (5) Reduction of dust in the foundry.

Molding Sand Requirements. The Pontiac Motor Div. foundry produces approximately 1000 tons of automotive gray iron castings per day, which vary in weight from 11 oz to 300 lb. The castings are made on eight mechanized molding lines, which are supplied with sand by three separate sand systems. The sand is conditioned in seven batch-type mullers, which under normal requirements, deliver 4200-lb batches at 2-min intervals. Slurry, seacoal, and water additions are made during the mixing cycle to produce molding sand that conforms to established standards of green strength, moisture and seacoal percentage.

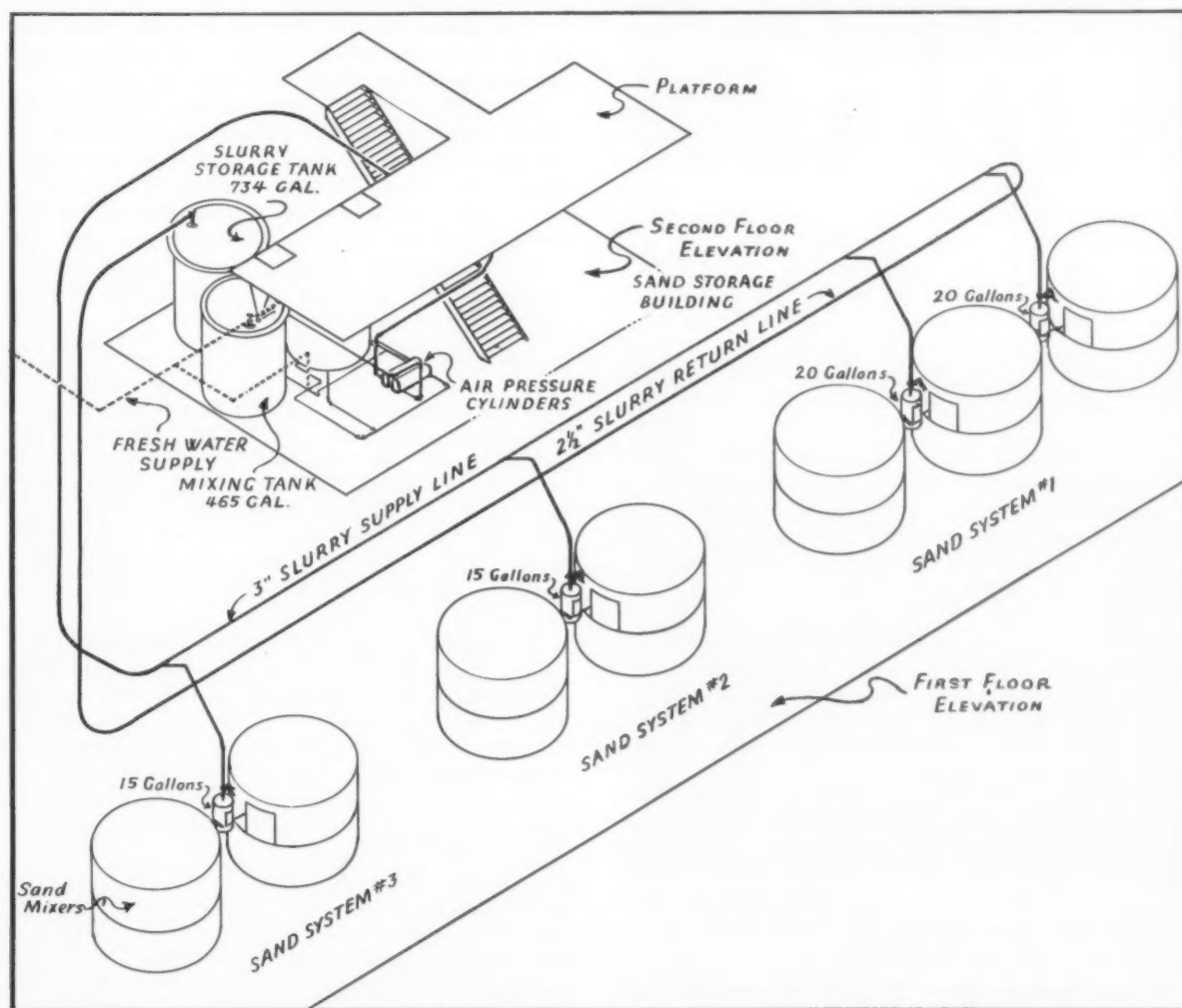
Hourly tests of samples taken from the molding lines are made in the sand laboratory and the results are posted at the sand mixers. These tests are the basis

for determining the slurry, seacoal, and water additions, and are also used by the molding foremen in analyzing molding and production problems. Although the sand standards are different for the three system sands, they all fall within the following range of sand properties:

Permeability	95 to 150
Moisture	3.0 to 4.0%
Seacoal	5.0 to 8.0%
Green Strength	3.0 to 4.0 lb shear

Sand losses due to carryout on castings are partially replaced by core disintegration at the shake-outs. Additional replacement, when necessary to maintain the desired volume in the systems, is made by trucking sand from the cylinder block knockout.

Bonding Clay Requirements. The bonding clays used are, western bentonite and a high strength fireclay, in the proportion of three to two. The bentonite, which forms a colloidal solution with water, not only supplies green strength to the molding sands, but serves as the suspending agent in the slurry. Since finely ground western bentonite has a tendency to gel and form waterproof coatings upon contact with water, it is sup-



Simplified diagram of slurry system components in use at Pontiac foundry.



Two slurry mixing tanks at right and above have a capacity of 465 gal; surge tank at left holds 700 gal. Each of tanks is equipped with propeller agitators to prevent settling of the mixture.

plied in pellet size with an average AFS grain fineness of 106. This larger size successfully overcomes the gelling tendency and lends itself to easy wetting. The fire-clay, which averages 184 grain fineness, gives green strength to molding sands and provides plastic qualities, which are important to production molding.

One gallon of the slurry contains approximately 1.1 lb of the clays and has a total weight of 9.1 lb. It has a viscosity of two and one-half times that of water and a specific gravity of 18° Baumé. Both types of clays are received in 100-lb paper bags and are stored in the slurry mixing area, located at second floor elevation.

Slurry Making Process. The process of making slurry from dry clay is one of dispersing and wetting. This is accomplished by the use of two dispersing units, which are V-shaped hoppers designed to receive the clay from the bags and feed it out at the apex of the V through adjustable horizontal slits. These units are mounted over mixing tanks, each having a capacity of 465 gal.

A sheet of water is directed through the falling clay causing it to "beavertail" into the mixing tank in a pattern that results in the best method of wetting and dispersing. Motor driven propeller agitation is provided in the tanks to complete the process, and eliminate gelling and settling.

When 300 lb of bentonite and 200 lb of fireclay have run through the unit, water is added to fill the tank, which brings the solution to the proper clay to water ratio. At least once each day, several batches of water are pumped through the system. This clears the lines of any clay accumulations that could grow to the extent of restricting circulation.

Pump Operation Data. The present pumping unit was designed and built by the foundry maintenance department, to eliminate wear caused by the abrasive

action of the clays in the slurry. It replaced an earlier installation of positive action pumps which required frequent maintenance attention and periodic replacement of costly parts.

The pumping action is centered in two 35-gal cylindrical pressure tanks mounted at main floor elevation, which fill by gravity and discharge by admission of 15 psi air pressure. A continuous flow of slurry is maintained by the alternate discharge of the tanks into the lines. The cycle of filling and discharging is controlled by an adjustable electric timer which actuates solenoid air valves. These valves begin the cycle by exhausting the air from one tank to permit it to fill and simultaneously admitting air into the other tank to effect its discharge. The action in each tank is then reversed, when activated by the timer, to complete one pumping cycle.

Check valves above each tank open automatically to admit slurry when tank pressure is relieved, and similar valves below each tank open to permit discharge into delivery lines when air pressure is built up in the tanks. Air is obtained from high pressure sources and is reduced to 15 psi to decrease consumption, reduce wear on delivery lines, and make easier handling at the outlets.

The pumping unit progressed through several stages of improvement before reaching the present arrangement. Some of the changes that were made are:

1. Substituting the electric timer for electrodes to actuate the solenoid valves. The electrodes, which were immersed in the slurry, were the cause of frequent failures due to the insulating effect of clay coating.
2. Relocating the pumps from second to first floor level to increase the rate of filling by gravity.
3. Repositioning the tanks from a horizontal to a vertical position to reduce the tendency to build up on the bottom of the tanks.

Delivering and Measuring. Recirculation being essential to avoid settling and the resultant clogging of delivery lines, the slurry is in constant circulation. It leaves the pumps by way of a 3-in. pipe line which runs parallel to the row of sand mullers and returns through a 2½-in. line to the mixing room, discharging into a 700-gal surge tank. It then flows back to the pumps for recirculation. A gate valve at the end of the 2½-in. return line is used to restrict the discharge, which helps to maintain line pressure and reduce unnecessary abrasive wear in the system.

Slurry additions for each batch of sand are measured in gallons by means of metering tanks installed at the sand mixers. These are so located that each tank can serve two mixers, and a fourth tank is provided for the seventh or odd mixer. The tanks are filled by means of quick opening valves, and the additions are made by opening similar valves below the tanks. A glass side on each tank is graduated to indicate the number of gallons drained into the mixer.

Each tank is provided with an overflow pipe which spills into the mixer. This precaution eliminates the possibility of breaking the glass, should the tank be overfilled and subjected to line pressure. The slurry is given good initial distribution over the batch of sand, by discharging through two outlets which rotate with the muller plows.

General Operating Practice. The ratio of clay to sand that must be maintained in a system sand is determined by molding and casting requirements. The amount of clay which must be replaced to maintain this ratio is affected by: (1) The clay-sand ratio, (2) Type and weight of castings made, (3) The quantity of sand which spills into the system from collapsed cores, (4) The type and quantity of other sand replacement that must be made to maintain volume, and (5) The amount of sand that is carried out with the castings. The three sand systems are each affected to a different degree by the above conditions. Since one slurry mixture is used in all systems, the mixing practice varies.

The No. 1 sand system, which services the cylinder block and cylinder head lines, requires from 15 to 20 gal of slurry per batch to satisfy strength requirements. An extra addition of water up to 5 gal is usually necessary to reach the proper percentage of moisture.

The No. 2 system in which axle carriers and small parts are made, demands a smaller clay replacement, usually from eight to 14 gal of slurry. Additional water varying from none to 5 gal may be added.

No. 3 sand system, supplying sand for manifolds and clutch housings, requires from 2½ to 5 gal of slurry per batch. Three to 5 gal of water is usually needed.

When more than normal clay additions are needed to bring up sand strengths, the slurry additions are increased and the water correspondingly reduced.

Conclusion. Use of slurry has resulted in better control of molding sand mainly by increasing the accuracy of clay additions to the sand mixers. Because of the 1 lb per gal dilution of the clay in the slurry, the deviation in clay is now reduced to that proportionate part of any error in slurry measurement.

The "balling up" of clays that existed with the dry method, sometimes to the extent of being visible, is not now apparent. This improvement in the distribution is undoubtedly due to the fine division of clay in the slurry, plus the action of water in assisting rather than retarding the distribution of the clay in the sand mixers. The distribution is also improved by the decrease in time for a slurry addition as compared to clay plus water in separate additions, thus utilizing a greater part of the mixing cycle for mulling and distribution.

Conversion to the use of slurry has also eliminated the trucking of clays from storage to the mixers and the handling, storing, and feeding of dry clays at the mixers. The effects upon housekeeping and dust control alone makes the use of slurry worthwhile at Pontiac. Clay consumption has been reduced approximately 25 per cent.

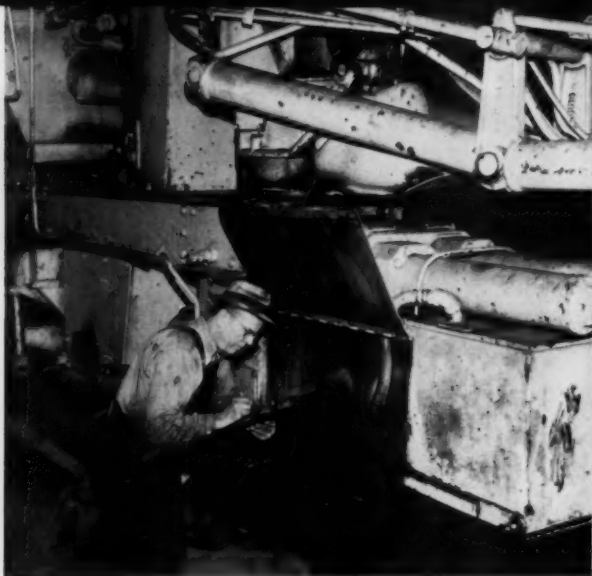
As a result of success in the addition of clays to molding sand through the slurry method, experiments have been conducted intermittently during the past three years relative to the feasibility of using this method to carry seacoal to the foundry system sands. So far, it has been determined that the present slurry mixture is capable of carrying up to 1¼ lb of seacoal per gallon. However, this project would involve the installation of special equipment to deliver seacoal to the slurry mixing room. The installation of such equipment is under consideration, but will require further experimentation and improvements.



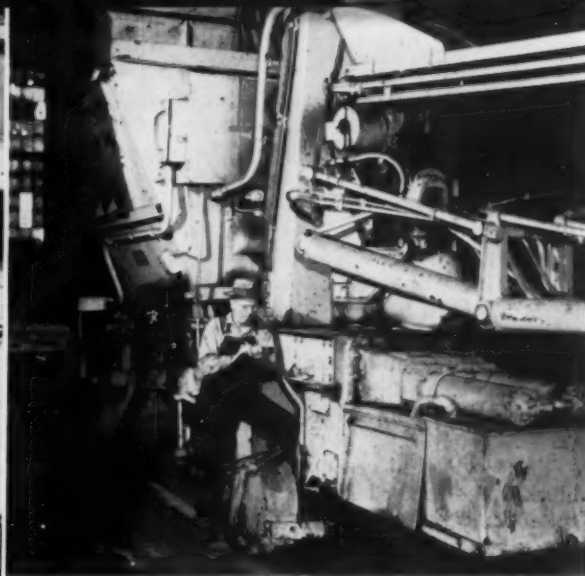
Two air-pressure pumps (each consisting of two 35-gal cylindrical tanks) force slurry to mullers. These pumps replaced positive action pumps after latter required frequent maintenance and periodic replacement of costly parts due to abrasive action of slurry.



A Pontiac Motor Division foundry worker checks amount of slurry flowing into sand mixers. Glass gauge on side of metering tanks indicates number of gallons of slurry drained into sand mixer. Slurry is discharged into the mixers through two outlets which rotate with muller plows during the operation.



Parts subject to sand contamination, such as hydraulic pump housing should be inspected daily.



Manufacturer's lubrication scheduled should be followed closely, checked off carefully.

Maintenance of Molding Machines

E. W. GREENLEES / *Superintendent of Maintenance, Kensington Steel Co., Chicago*



E. W. Greenlees

Proper maintenance of molding machines improves operations, extends equipment life, reduces accidents. The author describes the maintenance cycles in use at Kensington Steel Co.

■ **Unscheduled maintenance** downtime in jolt-rollover-pattern draw molding machines can often be

Detailed records can often prove invaluable in trouble shooting; lubrication data should be kept.



traced to disregard of the proper operational procedure. Here are a few of the common faults in handling this type of equipment.

Excessive jolting of flasks soon shows in wear and performance. All machines are designed for a rated capacity and, although occasional overloading is not injurious, repetitive misuse soon causes downtime.

Many new operators tend to clamp the flask or even to draw the pattern with the positioner valve. The positioning head should be positioned before clamping is begun and then left in that position. It is not intended for clamping or drawing.

Keep Machine Clean

The operator should keep the machine clean. The rollover-pattern draws at Kensington are equipped with blowoff valves to keep cylinder bases clean and free of sand, one of the most abrasive materials known. When mixed with hydraulic oil it becomes, in effect, a crude form of paste abrasive. Keep sand away from the hydraulically-operated positioning head or from any grease fittings.

The jolt table air cock must be carefully adjusted for different weight molds. A 4-lb mold does not require as much air as a 200-lb unit.

The following schedule has proved extremely successful in minimizing downtime at Kensington Steel.

Daily Maintenance

1. Keep the machine clean.
2. Keep correct oil level in dashpot cylinder. Periodically remove cylinder head, inspect oil for contamination, and examine relief valve on piston head.

3. Keep sand from accumulating at base of rollover cylinders, where it can cause shaft to bend during rollover.

4. Keep blow pipe under table clean and working.

5. If jolt adjustment is incorrect for weight of mold, table may wobble or rebound and damage the table guide pins. Check adjustment.

6. Examine locking levers and hooks for secure locking for rollover. Replace worn parts.

7. NEVER grease equalizer shoes. If they become smooth, remove and roughen them slightly with a file or abrasive.

8. Check ways and draw clamp slide for lubrication and cleanliness. A gummy slide will cause a jerky, slow draw.

9. If flask shifts during rollover, examine equalizer locking piston, locking levers, and clamp and draw cylinder.

Weekly Maintenance

1. Tighten all bolts weekly, especially those holding jolt cylinder to base and those holding cradle bearings to base.

2. Check jolting action to see that cradle is not jolting with table. At least 1/16-in. clearance is needed.

3. Inspect table guide pins and bushings to be sure they are not worn or binding. They can cause trouble with locking of table and jolting.

4. Check cylinders occasionally for air leakage. If air is leaking along piston rod, take up on packing glands.

5. If rollover is slow, check rollover cylinders. If air is blowing past cup leathers of piston head, it will come out exhaust of rollover cylinder.

6. Check cup leathers of draw and slide piston head. Air blowing past will cause jerky draw.

7. Check ways and draw clamp slide for lubrication and cleanliness. A gummy slide will cause jerky, slow draw.

8. When ways wear, shims can be removed and gib adjusted to compensate.

Maintenance experience at Kensington indicates the following basic troubles, listed according to the portion of the cycle in which they occur, may be encountered.

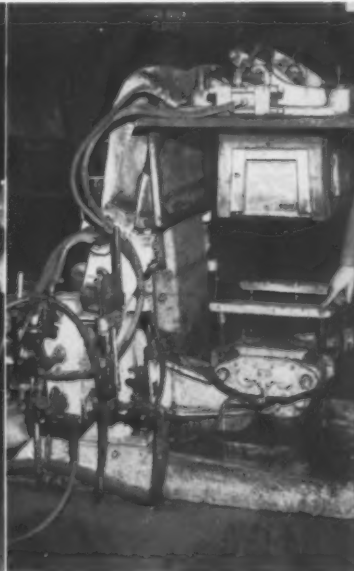
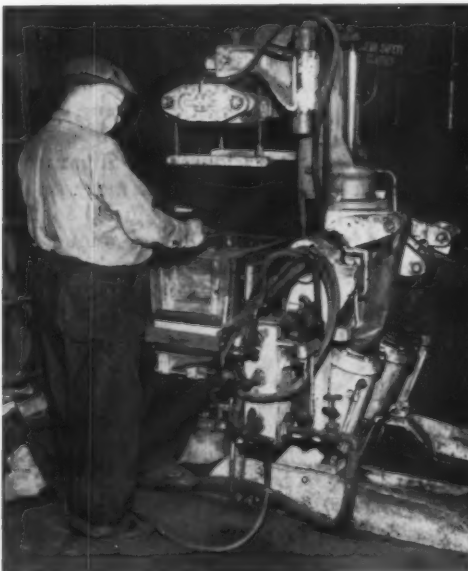
Erratic jolting can be traced to one or more sources. The air cock may be adjusted with regard to the mold weight. Sand may have built-up between the table and piston; the cradle may be jolting with the table; air pressure may be varying; air may be blowing past the jolt piston cup rings; or, the table guide pins and bushings may be damaged.

Equalizers May Be Worn Smooth

Shifting of the flask during rollover is usually caused by one of several factors. The equalizers may be worn smooth or have been greased by mistake, or the operator may be using the positioner instead of the clamping cylinder to clamp. Clamping may be inaccurate because of the clamp and draw slide "bottoming" before full clamping takes place. The equalizer locking piston may be leaking or the table locking levers and pins may be worn or bent.

A slow rollover is usually caused by low air pressure, by overloading the machine, or by incorrect operation of the rollover valve. If, on inspection, none of these apply, then air is undoubtedly leaking along the piston rod or past the piston head cup leathers. Should the cradle bang violently upon rollover, then the dashpot cylinder is at fault. The oil may be low or contaminated or the dashpot cylinder relief valve may be sticking.

Slow or erratic drawing usually results from improper operation. The locking stud may have been left tightened, air pressure may be low, the table may be insecurely locked, or the operator may be using

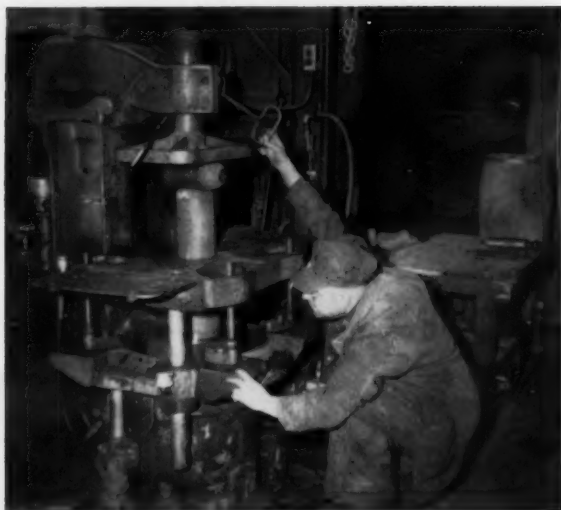


Jolt-rollover pattern draw machines should be blown free of sand several times daily (left), with particular attention to column bearing housings. Several times during day,

underside of positioning head should be blown free of sand (center), a procedure often overlooked. Flask equalizer bars (right) should be greased under no conditions.



Leader pins and bushings are cleaned daily with kerosene, and all parts lubricated (left). At end of each shift, all sand is cleaned from machine (above), particularly around and under leader pins.



(Above) Mechanic checks leader pins and bushings for operating condition. (Below) Air cylinder that operates duplex gate on sand hopper is checked.



the positioner to draw. Air may be leaking past the piston rod or piston head leathers, or the clamp and draw slide may be dirty or worn.

An erratic operation of the positioner usually indicates a leaky oil line or low oil level. Another fault, however, is air in the line. Should the positioner head retract under load, dirty or damaged seal rings are at fault, or the cylinder walls may have become grooved. Dirt may also have lodged in either the check or pilot operated two-way valve. If the head retracts only partially, the line is leaking or the oil level is incorrect.

Machines Simple in Construction

Jolt-pin lift machines are simple both in construction and operation and present rather simple maintenance problems. Other than occasional checking of guide pins and bushings for wear, and keeping sand from accumulating, few problems occur.

If slinger-type machines are blown clean once a day, no sand trouble should occur. Conveyor belts and frames should be inspected occasionally for alignment. They should be kept level and allowed to move freely laterally. The frame height must be adjusted so the belt just clears the frame. It must be low enough so there will be no wear from the belt, and high enough to prevent sand from slipping under and building up between it and the belt. The belt should be tight enough to prevent slippage, but not tight enough to cause excessive wear on the pulley bearings.

One point, often overlooked, is the value of using factory made parts. Fabricating or buying substitute repair parts can be false economy. Often a part may appear to be far more rugged than its application would seem to call for. There was a reason for this when the machine was originally designed. A stress may be transferred from some portion of the machine to the part in question under some condition of operation. To save a few pennies and then at some future date to lose the machine because the part didn't hold up is false economy.

Sixteen new-type wax pattern injection machines are used in Howard Foundry's lost wax precision investment casting plant. Machines are operated by a push button. Wax temperature, injection pressure, and die clamping are controlled automatically. Room is air-conditioned to 72 F to maintain tolerances of wax parts.



Lost Wax Process Engineered For Precision Castings

K. J. YONKER / *Plant Manager, Precision Investment Casting Div.,
Howard Foundry Co., Milwaukee, Wis.*



From left: George Anderson, purchasing agent; Ralph Doubek, experimental manager; George Stolze, production superintendent; author K. J. Yonker, plant manager; and Pat Kelly, now plant manager, West Coast Division, meet in wood-paneled conference room to plan design of patterns and production techniques for new part.

■ In the fall of 1953, Howard Foundry Company's lost wax precision investment casting division in Milwaukee, Wis., started moving into a newly purchased building with about 33,000 sq ft of floor area—more than double the area of the former plant. Today, some nine months later, this building has almost 65,000 sq ft of floor area, and production capacity has been increased five fold.

A second floor has been built over the original office and engineering building adjoining a 260-ft long, two-story production bay. In the front end of about one-sixth of this bay, another floor has been built, providing space for new metallurgical and chemical laboratories including x-ray, fluorescent penetrant, magnetic particle, and inspection departments.

Personnel Suggestions

Some of the facilities incorporated into this plant are the result of suggestions by personnel. For example, one man suggested a conference room. In the past, there was never adequate room for weekly production meetings.

The new plant has a soundproof conference room that is 17 x 22 ft. It has a blackboard and motion picture screen built into an end-wall. A soundproof telephone booth can be used without interrupting a



Plaster book mold is separated to remove wax sprue. Sprues are molded of wax collected from run-off pans in de-wax oven. Patterns are always made of new wax.



Operator ejects thin-wall blade pattern, is responsible only for removing dies from machine, die separation and assembly, and ejection of the wax pattern.

meeting. A conference table, 16 ft long was built in the room; to get it out, it would have to be knocked down. The table seats 18 and is modeled after the President's cabinet table in Washington, D. C.

The morale-building effect of this conference room on supervisory personnel has been obvious from its first use. It has a congenial atmosphere for union-

management meetings, customer presentations, and education sessions which may feature plant safety films or films about other industries.

The engineering department now has enough space for twelve 6 x 3-ft drafting tables, although only eight are needed at this time. Blueprint files are centrally located. Glass brick sections were built into east and



Wax pattern assembly tables are equipped with Bunsen burners at each assembly station. Wax patterns are bonded to sprues with wax. Note conveyor belt below high counter of table. Assemblies are conveyed to inspection station and then transferred to the primary department.

Precision Casting Facts

Castings made by Howard Foundry's Milwaukee investment plant have the following qualities: Tolerances—overall, ± 0.003 to ± 0.008 in. Size—approximately 7 in. in any one dimension. Weight—average about 8 lb. Wall Thickness—minimum usually not less than 0.045 in. although can go down to 0.030 in. when required. Tapered parts may have edge thickness as little as 0.030 in. Holes—same tolerances as rest of part. Diameter in a $\frac{1}{4}$ -in. section may be as small as 0.050 in. Finish—average, as-cast finish is 125 micro-inches; may be as low as 70.



(Left) Three hundred-mesh sand clings to binder applied to pattern assemblies in primary investment. Base of sprues must be wiped to expose wax, permit better bonding action.



(Right) Stainless steel flask is bonded with wax to bottom board in preparation for secondary investment of heavy slurry. Note primary invested assemblies in background.

west walls, to give the engineers as much natural daylight as possible.

Fifty Per Cent Women

Employment is about 500 people now as compared to the former figure of 150. About 50 per cent of total personnel are women, most of whom work in wax injection or wax assembly production. Large, convenient rest rooms are located in basement locker rooms for both men and women. Since many of these



Vibration table settles secondary investment slurry to eliminate air bubbles and fill out detail around wax assembly in flasks. When slurry becomes firm, bottom boards and paper tops containing soft slurry are removed from flasks. This newly-designed vibration table is relatively quiet and requires little maintenance.

employees are on a piece-rate basis, small rest rooms have been located near each department. Careful location has helped to cut lost time.

Much of the equipment now being used in the lost wax precision investment industry has been designed by individual foundries. Howard Foundry is no exception. Long before moving into the present plant, the engineering department had worked on designs of new equipment and refinements of stock equipment.

The new plant has 16 new automatic wax injection machines that are so simple in operation that a five-minute instruction course makes a competent operator. With the exception of separating or assembling dies and ejecting wax patterns, an operator need only know how to push a button. In these machines, wax temperature is thermostatically controlled. Temperature will change to conform to type of wax and type of job. A low temperature wax may be held at 140 to 160 F; a high temperature wax, 180 to 200 F. Wax pressure injection range will vary from 500 to 1000 psi, depending on die complexity. Hot wax and injection pressure heat up dies; to keep them cool, dry ice is often used.

Making of Sprues

Two 25-gal and five 15-gal wax holding tanks are located in the sprue-making department. These tanks are heated to keep wax in a liquid state, ready for use. Sprues are made in plaster book molds held together by simple clamps. Molds are greased on the inside before assembling to promote easy removal of the hardened wax sprues.

About 60 women are employed in wax pattern assembly, a hand assembly job. To speed up assembly, new production tables are used, with two being 45 ft long, one 30 ft long. Wax patterns are attached to



Molds are marked with production numbers, then placed in 40-ft continuous, conveyorized de-wax oven where wax is melted at 350 F in 1½-hr cycle. This is point in process where "lost wax" name is derived.

sprues and then placed on a motor driven conveyor belt running along the back of each table. The belt is controlled by an inspector stationed at one end. He checks, racks, and transfers assemblies to the primary investment department.

Investment Department

The primary investment department is separated from wax pattern assembly by storage racks. Operators dip the assemblies into a liquid binder. A fine sand of about 300 mesh is then dusted over the binder to give the investment castings their fine finish. Finish may be as good as 70 micro-inches. Primary invested assemblies are then bonded with wax to bottom-boards. Stainless steel flasks with stapled 12-in. paper top

extensions are put over the assemblies and "waxed down." The flasks are then sent down an elevator to the secondary investment department.

Here, sand and wet materials are mixed in 150-lb tumblers. Magnesium oxide is mixed with the investment to speed up hardening of the slurry. When thoroughly mixed, the operator scoops out the slurry and pours it into metal flasks holding the primary invested assemblies.

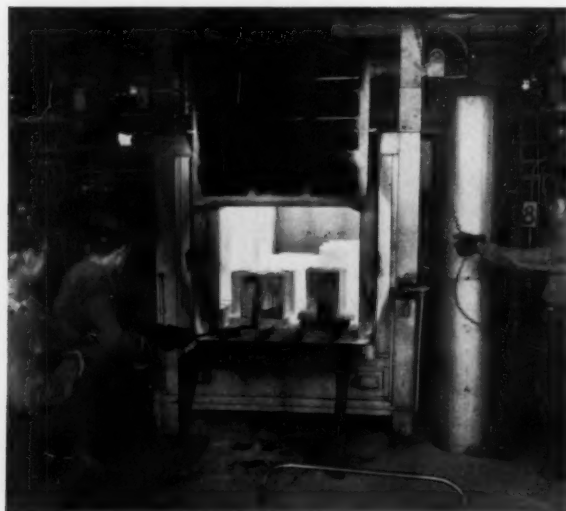
Eliminate Vibration Noise

When flasks are filled, they are placed on a vibration table, which settles the slurry, filling out pattern detail. Vibration tables have always had one disturbing feature: they're noisy. Vibrators usually work on cams and striker plates which have to be adjusted frequently. Howard engineers designed a vibrator that uses one main crank shaft and connecting rod. This unit is quiet, far more efficient, and requires little maintenance. It distributes an even vibration over the entire 5 x 5-ft table area.

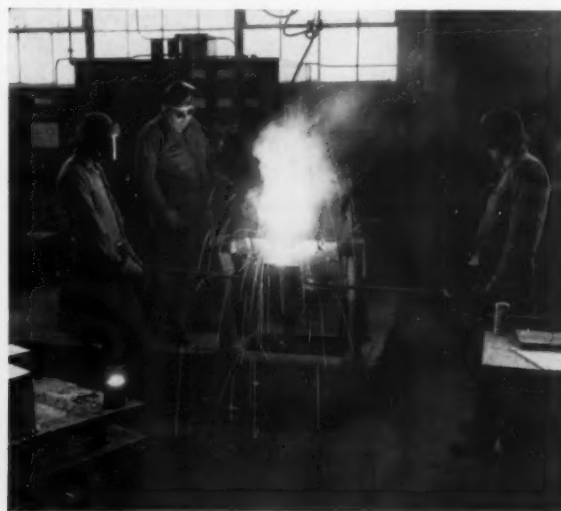
After the molds have been shaken down, they are transferred to the foundry bay. Paper tops containing soft slurry are cut off. A production number is then painted on each mold. The molds are then placed in a 40-ft continuous, conveyorized de-wax oven, which was designed and built to specifications. This oven is quite a departure from earlier equipment, which had to be operated by hand. The oven is automatic and is far more efficient, distributing a temperature of 350 F evenly over all the molds. Molds take about an hour and a half to move through the oven.

Here's where the process gets its name of "lost wax." Wax melted out of the molds drops into run-off pans underneath the chain belt carrying the molds. While this wax cannot be used for patterns again, it is collected and used in making sprues.

Molds are stored on racks after de-waxing and are held for their specific heats. Thirteen gas-fired mold curing furnaces are used in the plant today; the old plant had but four. Molds are heated and held at



Molds are removed from mold-curing furnace after being held at 1800 F for six to eight hours. Heating cycle is automatically controlled and recorded.



Induction melting furnaces, powered by 100-kw, 3000-cycle electric motor and generator set, have excellent self-cleaning and purification characteristics.



High-speed friction band saw is required to cut off sprues and risers from the castings. In effect, the saw melts its way through the hard-to-machine steel alloys (above), which are being cast principally in the lost wax process as used at Howard Foundry.

a temperature of 1800 F from six to eight hours. This volatilizes all remaining wax, prevents gases from forming in the mold when pouring the melt, and cures the mold to withstand the temperature of the molten metal.

Hot molds are removed from the furnace and poured immediately. They are not allowed to cool. Metal pouring temperature ranges up to 3200 F. Because of the high temperature of the molds, better feeding and cooling conditions are obtained. Cooling takes much longer than sand casting. Sounder and denser castings are produced with only slight enlargement of grain size.

Melting Procedure

Melting is done in induction furnaces, a 200-lb, 100-kw unit and a 100-lb, 100-kw unit. Induction melting is preferred since it provides self-cleansing of the metal because of its stirring action. Also, the furnace doesn't pick up carbon as in arc melting furnaces. Induction melting is relatively fast. About 45 minutes are needed to melt and pour. Melting capacity may seem small, but it should be kept in mind that small parts are being cast. One mold may contain as many as 64 casting cavities when the part is, say, under 3 in. in diameter.

The plant works with a wide variety of ferrous and non-ferrous metals, as do other investment casting



Photo record of gating and risering techniques designed to produce parts are photographed and catalogued with information on alloy, weight, dimension, and production characteristics. Photographic equipment consists of 4 x 5 press camera with self-developing unit attached to back.

foundries. Versatility is a necessity as is equipment flexible enough to handle virtually any alloy. Alloys cast include austenitic steels, stainless steel, precipitation hardening stainless, copper, brass, and aluminum as well as nickel and cobalt-base alloys.

Every new part entering the foundry is first tested for production in the research department. Gating and risering techniques are tried, and experimental cast parts are critically examined and recorded. To record experiments, a regular 4 x 5 press camera with a self-developing camera attached to its back is used. Photos are taken through the superior lens of the press camera and exposed on the film of the second camera. It takes about 60 seconds to snap a picture and get a finished print. No particular skill is needed and no dark room experience is required; the dark room is in the self-developing camera.

Photography is a quality control technique that can help get a foundryman out of trouble faster. For instance, if a casting run develops a flaw suddenly, the photograph library usually shows how a similar problem was solved. If not, the engineers resort to experimentation, with photos of each technique used. This visual library of problems and solutions of production has proven invaluable for reference on how to produce a new casting job. It helps train new personnel and eliminates chances of error on the part of experienced personnel.



J. V. Dawson



L. W. L. Smith



B. B. Bach

Some Effects of Nitrogen in Cast Iron

J. W. DAWSON, L. W. SMITH, and B. B. BACH / *B.C.I.R.A. Research Dept.*

Carbide stabilizing effect of nitrogen in gray iron, nodular iron, and malleable iron, and influence of nitrogen on graphite in gray cast iron, are treated in Research Report No. 355 of the British Cast Iron Research Association. The paper, which originally appeared in the June 1953 issue of the *B.C.I.R.A. Journal of Research and Development*, is reprinted here by permission of the Association. The installment printed in this issue is the first, the second will follow in the August issue of *AMERICAN FOUNDRYMAN*.

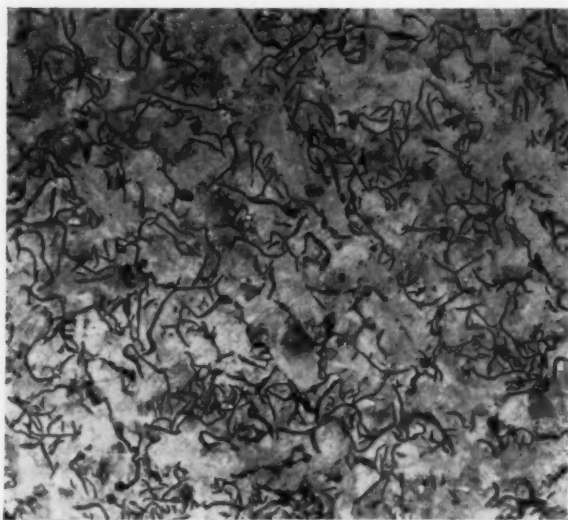


Fig. 1—Etched in 4 per cent Picral $\times 100$. N = 60 ppm.

■ It has been known for a long time that gases have an effect on the properties of steels. Similar effects have been suggested for cast iron. Oxygen, hydrogen, and nitrogen contents of commercial cast irons show a wide variation so that it is reasonable to suppose that they may in some way affect the properties. They may in fact be responsible for some of the anomalies reported from time to time. This paper gives an account of some of the effects due to nitrogen.

Solubility of Nitrogen in Iron. The solubility of nitrogen in pure iron at 1550 C is approximately 0.04 per cent. This solubility is affected by the presence of other elements. Briefly, the effects of silicon, carbon, nickel, chromium, vanadium, and manganese on the solubility of nitrogen in molten iron are:

1. Silicon increases solubility up to about 1 per cent Si and then causes a decrease.
2. Carbon decreases solubility up to 4 per cent C.
3. Nickel decreases solubility steadily to almost zero at 100 per cent Ni.
4. Chromium considerably increases the solubility.
5. Vanadium increases the solubility even more than chromium.
6. Manganese increases the solubility.

The effect of the simultaneous presence of two or more of these elements is not known.

Effect of Nitrogen. The best known effect of nitrogen is the strain-age embrittlement of low carbon steels. Imai and Ishizaki¹ show that it is due to a change in the solubility in alpha iron below 580 C. This embrittling effect is greatly reduced by the addition of aluminum, titanium or molybdenum, which form stable

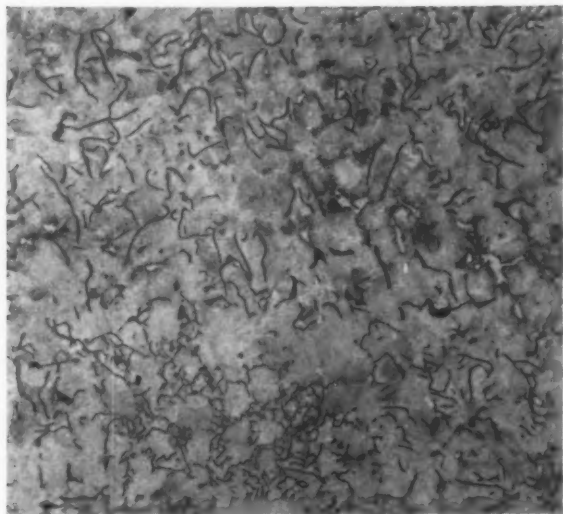


Fig. 2—Etched in 4 per cent Picral $\times 100$. N = 200 ppm.

nitrides, titanium being the most effective. These workers also show that small amounts of phosphorus enhance this effect of nitrogen. This opinion is supported by Enzian² who also shows that nitrogen is five times as harmful as phosphorus in embrittling steel.

Free vs. Fixed Nitrogen

Other effects found by Enzian² to be due to nitrogen in low phosphorus steel are an increase in the strain-aging and tensile strength and a reduction in impact strength and elongation. These effects of nitrogen were reduced by aluminum or titanium.

Geil and others³ show that although they had no knowledge of the effect of "free" nitrogen (as opposed to "fixed" nitrogen contained as stable nitrides) on the transition temperature for the change from ductile to brittle fracture of steel, a high content of aluminum nitride was actually beneficial as it lowered this transition temperature. The steel was therefore ductile over a wider range of temperatures.

Aluminum nitride is also said to control the shape of the grains formed when cold-rolled low-carbon steel sheet is heated slowly during its final anneal⁴. The nitride precipitates at the distorted, cold-rolled grain boundaries during the slow heat up and thus causes the recrystallization to follow this distorted pattern. Rapid heating, however, does not allow sufficient time for the nitride to precipitate before recrystallization takes place. This is said to be most effective between 0.015 per cent and 0.066 per cent aluminum.

Nitrogen Fixes Boron

Imai and Imai⁵ state that boron only improves the hardenability of carbon steels when the nitrogen is less than 0.008 per cent, or when the steel is heavily "killed" with aluminum or titanium, but not silicon; and conclude that this is because aluminum and titanium form more stable nitrides than silicon. They suggest that a high nitrogen content fixes the boron as boron nitride and renders it inactive. Similar conclusions were also formed by Digges and Reinhart⁶.

The fixation of nitrogen by aluminum is postulated

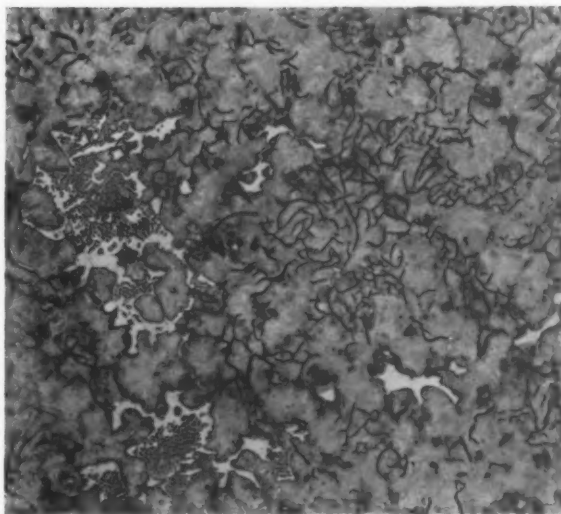


Fig. 3—Etched in 4 per cent Picral $\times 100$. N = 235 ppm.

as the possible cause of graphitization of plain carbon steels at sub-critical temperatures⁷. It is suggested that "free" nitrogen has a carbide stabilizing effect which is reduced by aluminum due to the formation of aluminum nitride. Dennis,⁸ however, suggests that a fine dispersion of alumina, particularly at the grain boundaries, causes this sub-critical graphitization.

Further evidence of the carbide stabilizing effect of nitrogen is given by Cowan⁹ who states that nitrogen added to the melt retards the annealing of malleable iron, although no evidence is produced.

Jordan¹⁰ in a recent patent claims that the addition of nitrogen as magnesium nitride or other nitrogen-bearing compounds to magnesium nodular irons, increases the "toughness" of the casting.

Aluminum Nitride Inoculates

Piowowsky¹¹ suggests that titanium-nitrogen compounds refine the graphite in cast iron by forming an abundance of graphitizing nuclei. Rauterkus¹² found that by adding aluminum to a melt and then bubbling nitrogen through it he could produce an inoculating effect which he attributed to the formation of aluminum nitride.

Methods of Adding Nitrogen. During the preparation of the foregoing review it was noticed that calcium cyanamide had been used to add nitrogen to molten steel³. Additions of this compound were made to molten cast iron but the results were disappointing, very little increase in nitrogen being obtained. (Nitrogen determinations were carried out either by vacuum fusion or chemical distillation. Latter method is described in the *B.C.I.R.A. Journal of Research and Development*, vol. 4, no. 12, June 1953, pp. 553-559.) It was thought that this might have been due to poor contact between the finely divided powder and the molten metal, and it was suggested that the use of a fluxing material such as soda ash would improve the solution of the nitrogen.

It was already known that some case-hardening compounds add nitrogen as well as carbon to solid steel on heating. Some preliminary tests were carried

TABLE 1—EFFECT OF VARIOUS ADDITIONS ON THE NITROGEN CONTENT: MELT NO. 1

Melt No.	T.C., per cent	Si per cent	Mn per cent	S per cent	P per cent	Ca per cent	N p p m	Additions to Melt
1a	3.34	1.70	0.51	0.096	0.110	n d	65	No treatment
1b	3.32	1.68	0.48	0.081	0.110		70	4 oz. NaCl
1c	3.34	1.67	0.50	0.091	0.106		125	4 oz Na ₂ CO ₃ per 45 lb. metal for 70 sec
1d	3.35	1.66	0.54	0.075	0.112		170	2 1/2 oz ferrocyanide 45 lb metal for 70 sec
1e	3.29	1.69	0.52	0.066	0.107	n d	205	2 1/2 oz ferrocyanide 2 1/2 oz Na ₂ CO ₃ for 75 sec
								4 oz CaCN ₂ CO ₃ for 70 sec

Note: 1— p p m = 0.01 per cent; n d = not detected

TABLE 2—EFFECT OF NITROGEN ON THE MECHANICAL PROPERTIES OF HPO-EUTECTIC FLAKE GRAPHITE IRON MELTS NOS. 2 AND 3

Melt No.	Diameter of bar in.	Transverse		Ultimate Tensile tons/sq. in.	Impact Strength ft lb	Brinell Hardness No.	N p p m
		Rupture Stress tons/sq. in.	Deflection in.				
2a	0.875	27.6	0.139	16.3	14	212	35
		29.3	0.125				
2b	0.875	31.1	0.138	12.4F	14	204	40
		31.1	0.134				
2c	0.875	38.4	0.158	20.4	21	230	225
		36.8	0.150				
2d	0.875	34.3P	0.101	....	..	...	245
3a	1.2	25.5	0.235	14.1	15	188	60
3b	1.2	22.0	0.226	18.1	16	234	200
3c	1.2	26.7P	0.163	....	..	...	235

P = Porous

F = Flawed

TABLE 3—ANALYSES OF HYPO-EUTECTIC FLAKE GRAPHITE IRONS: MELTS NOS. 2, 3 AND 5

Melt No.	TC per cent	Si per cent	Mn per cent	S per cent	P per cent	N p p m
2a	3.41	1.49	0.57	0.082	0.058	35
2b	3.38	1.56	0.62	0.080	0.059	40
2c	3.41	1.52	0.62	0.077	0.069	225
2d	3.42	1.55	0.61	0.071	0.071	245
3a	3.43	1.61	0.62	0.085	0.054	60
3b	3.53	1.55	0.62	0.078	0.066	200
3c	3.52	1.56	0.62	0.075	0.069	235
5a	3.25	1.38	0.44	0.079	0.070	90
5b	3.29	1.30	0.44	0.068	0.084	355

TABLE 5—EFFECT OF NITROGEN ON THE MECHANICAL PROPERTIES OF HYPER-EUTECTIC IRON: MELT NO. 6

Melt No.	Diameter of bar in.	Transverse		Ultimate Tensile Stress tons/sq. in.	Impact Strength ft lb	Brinell Hardness No.	N p p m
		Rupture Stress tons/sq. in.	Deflection in.				
6a	0.6	23.0	0.120	9.1	..	157	50
6b	0.6	27.1	0.110	13.2	..	210	175
6a	0.875	17.2	0.130	7.9	9	141	50
6b	0.875	18.9F	0.110	12.4	12	191	175
6a	1.2	16.3	0.270	6.2	8	138	50
6b	1.2	22.1	0.270	9.9	9	185	175
6a	1.6	....	....	5.3	6	120	50
6b	1.6	....	....	9.1	7	185	175

TABLE 4—ANALYSES OF CHILL BLOCKS: MELT NO. 4

Melt No.	TC per cent	Si per cent	Mn per cent	S per cent	P per cent	N p p m
4a	3.53	0.60	0.52	0.042	0.052	70
4b	3.56	0.62	0.52	0.056	0.050	70
4c	3.69	0.62	0.52	0.055	0.052	90
4d	3.64	0.60	0.53	0.053	0.058	150
4e	3.63	0.61	0.52	0.047	0.058	240
4f	3.60	0.58	0.51	0.048	0.063	335

TABLE 6—ANALYSES OF HYPER-EUTECTIC FLAKE GRAPHITE IRONS: MELTS NOS. 6 AND 7

Melt No.	TC per cent	Si per cent	Mn per cent	S per cent	P per cent	N p p m
6a	3.29	3.46	0.58	0.077	0.067	50
6b	3.35	3.62	0.58	0.072	0.068	175
7a	3.72	2.09	0.76	0.025	0.055	20
7b	3.84	2.04	0.76	0.026	0.056	40
7c	3.82	2.03	0.75	0.026	0.058	80
7d	3.84	2.00	0.77	0.026	0.057	115

out with a proprietary mixture that was readily available and was known to contain sodium ferrocyanide and fluxing agents. These tests proved very satisfactory, the nitrogen content being increased from 55 ppm to 220 ppm for a low silicon cast iron and 35 ppm to 120 ppm for a normal gray iron. Sand cast bars from the gray iron before and after treatment showed a distinct difference in fracture. The treated bar was completely white, whereas the untreated one was gray. No significant change in composition apart from the nitrogen was found. This carbide stabilizing effect is dealt with later in this paper.

Tests were later carried out using the following additions:

MELT NO.	ADDITIONS
1a	None
1b	Common salt + soda ash
1c	Sodium ferrocyanide
1d	Sodium ferrocyanide + soda ash
1e	Calcium cyanamide + soda ash

Nitrogen determinations were carried out on samples from all the above. The results are given in Table 1. It can be seen from these results that fluxing improves the efficiency of the sodium ferrocyanide and that fluxed calcium cyanamide also increases the nitrogen content. It is also clear that treatment with salt and soda ash does not alter the nitrogen content. Another point to be noticed is that the sulphur contents have been reduced somewhat, though the reduction is not significant. More recently ammonium chloride, manganese nitride, and iron nitride have been used to make nitrogen additions. Of these, only the first two were successful, ammonium chloride having the advantages that no liquid slag is formed and no reduction of sulphur occurs.

A series of experiments was then carried out using the case-hardening compound, and later, a mixture of sodium ferrocyanide and soda ash, to add nitrogen. The amount of nitrogen added was varied by using different amounts of addition and treating for different lengths of time. The amount of addition varied between 0.1-1.0 per cent per 30 to 60 pounds of metal. The material was added to the surface of the metal in the ladle, stirred in with a plunger and allowed to stand $\frac{1}{2}$ to 4 min before casting.

Melts were carried out to determine the effect of nitrogen additions on hypoeutectic and hypereutectic flake graphite irons, and malleable and nodular irons. In all cases the melts were carried out in oil-fired crucible furnaces of either the lift-out or tilting type.

Hypoeutectic Flake Graphite Iron. Two melts (No. 2 and 3) of refined iron (carbon equivalent 3.9) were made, consisting of four and three taps respectively. Taps 2a, 2b, and 3a were untreated, 2c and 3b were given a light nitrogen addition, and 2d and 3c a heavier nitrogen addition. Melt No. 2 was cast into 0.875-in. diameter bars and Melt No. 3 into 1.2-in. diameter bars.

In each melt the best mechanical properties were found in the specimens with the light nitrogen addition (Table 2).

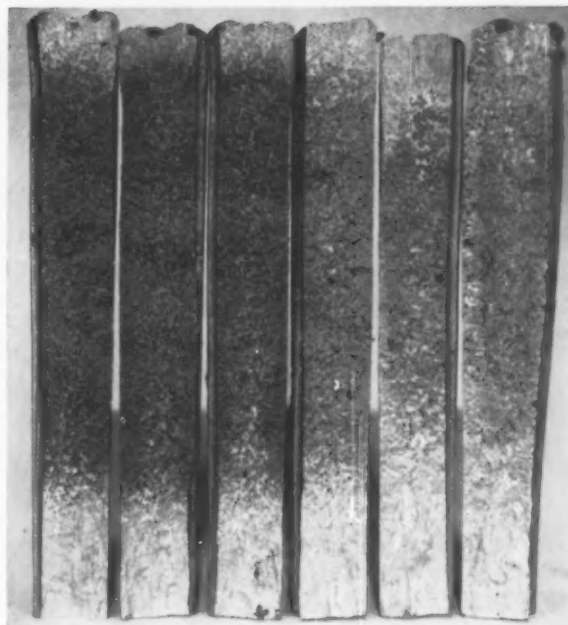


Fig. 4—Chill block fractures.



Fig. 5—Etched in 4 per cent Picral $\times 500$. N = 120 ppm.

There was also an increase in the Brinell hardness number with increasing nitrogen content. The bars with the heavier nitrogen addition were porous and mottled, and as a result the mechanical properties were impaired. As before, there was no significant variation in the chemical analyses (Table 3). Typical microstructures of the bars are shown in Fig. 1-3; it will be seen that there is an increase in combined carbon with increasing nitrogen content.

To determine to what extent nitrogen affected the chilling property of cast iron, a series of chill blocks, Melt No. 4, were prepared with increasing nitrogen contents. These were cast under conditions described by W. J. Williams.¹³ The analyses are given in Table 4 and the fractures of the blocks are shown in Fig. 4 arranged in order of increasing nitrogen content. It



Fig. 6—Etched in 4 per cent Picral $\times 500$. $N = 195$ ppm.



Fig. 8—Etched in 4 per cent Picral $\times 100$. $N = 175$ ppm.



Fig. 7—Etched in 4 per cent Picral $\times 100$. $N = 50$ ppm.

can be seen from this that nitrogen increases the depth of both the induced and natural chill. The spongy nature of the block with the highest nitrogen content shows that the limit of solubility in the solid iron has been exceeded for this material.

To ascertain whether the high nitrogen iron retained its nitrogen on remelting, the heavily treated bars from Melt No. 2 were remelted (Melt No. 5a) and were sampled for gas analysis and then heavily re-treated with nitrogen (Melt No. 5b). A set of bars of various diameters were cast from the re-treated metal but proved to be almost white and very porous. Considerable bleeding and mushrooming occurred in the larger diameter bars. The nitrogen content of the remelted iron was reduced considerably but was increased by re-treatment. The analyses are shown in Table 3 on page 64.

Another effect noticed in the hypoeutectic irons was that nitrogen caused an alteration in the shape of the graphite flakes. This was especially noticeable in Melt

No. 12, an iron prepared for sub-critical annealing. Details of composition are given in Table 8. In the presence of nitrogen the flakes became shorter, thicker, and had more rounded ends. They were also more curved. Fig. 5 and 6 illustrate the structure.

It was found that this effect of nitrogen could be neutralized by the addition of aluminum (Melt No. 13, Table 8).

Hypereutectic Flake Graphite Iron. Two melts were made of this type of iron. The first, Melt No. 6, was made from the refined iron used for the hypoeutectic melts, but with the addition of sufficient ferrosilicon to the charge to give a carbon equivalent of 4.5. Two taps were taken, the first one being untreated and the second one receiving a moderate nitrogen addition. One set of bars of various diameters was cast from each tap.

The treated bars showed a considerable improvement in the mechanical properties and an increase in the Brinell hardness number (see Table 5). The slight variation in carbon and silicon contents would tend to oppose both this improvement and the change of structure that occurred. The analyses are shown in Table 6 and the structures in Fig. 7 and 8.

A comparison of Fig. 7 and 8 shows that nitrogen treatment has changed a matrix consisting of pearlite and ferrite in roughly equivalent amounts to one consisting entirely of pearlite.

A second melt, No. 7, made from a hypereutectic hematite pig iron was cast into four sets of bars similar to those of the previous melt. The first was untreated and the remaining three sets received varying nitrogen additions. In this case, however, although a considerable change in nitrogen content was obtained (Table 6) there was little change in structure or properties. This may be due to the fact that the original pig iron contained titanium and vanadium. The effect of these and similar elements forming stable nitrides is at present under investigation. Results so far obtained show that titanium does neutralize the effect of nitrogen.—(Concluded in August issue.)

Cleveland Mayor Anthony J. Celebrezze (center) officially opens 58th Annual AFS Convention and Exhibit. W. L. Seelbach (left), Honorary Chairman of host chapter General Convention Committee, and National President C. L. Collins participated.

1954 AFS Convention News



■ Concluding its news coverage of the 1954 AFS Convention American Foundryman reports this month on papers presented in the fields of sand, gray iron, steel, malleable iron, dust control and ventilation, pattern, education, plant and equipment, refractories, cost, heat transfer, and plaster mold casting.

GRAY IRON

PROGRAM for the Gray Iron Division featured five technical sessions, three Shop Courses, and a Round Table Luncheon, spread over the entire Convention week.

The Wednesday afternoon session offered three papers. Chairman was V. A. Crosby, Climax Molybdenum Co., Detroit; vice-chairman and secretary: W. C. Jeffery, University of Alabama.

E. A. Loria, Carborundum Co., Niagara Falls, N. Y., reviewed "Studies on the Machinability and Microstructure of Cast Irons." Metallographic study of test specimens used by Loria showed that microstructure is a definite criterion of machinability. The presence of about five per cent free carbide in a given graphite-pearlite distribution, he said, decreases drastically both tool life and constant-pressure machinability.

Hardness in itself is not necessarily a criterion of machining quality, Loria declared. In a qualitative sense, however, machinability is a function of hardness and this property is usually chosen as the most convenient one upon which to base cutting speed and feed relationships. The presence of hard abrasive particles—

carbides, nitrides, some phosphides—and the size, shape, and amount of the ferrite and pearlite of the matrix structure, contribute the major effect on the machinability of cast iron because of the marked variation in microhardness of these microconstituents.

Loria maintained that variation in total carbon content, as a function of the carbon equivalent, is the controlling variable in producing a change in the machinability, rather than the silicon content. He reported investigations of the effect of steadite and various alloys on cast irons, and described test methods devised for the study of tool life.

Michael Field and J. F. Kahles, Met-cut Research Associates, Cincinnati, reported on "Machining Characteristics of Cast Irons." Pointing out that cutting characteristics of cast irons are affected by microstructure rather than by the criteria of hardness and strength, they described the characteristic structural properties of cast irons as an introduction to their paper. Turning to machinability, they said the three factors comprising this measure are tool life, surface finish, and power requirements. Tool life, they stated, is the most important, and uniform tool wear the desired type of tool failure.

In machining, Field and Kahles declared, a feed rate should be used that is as high as possible and will still provide adequate surface finish and accuracy. Steadite, when less than five per cent, has little effect on tool life, they asserted, but even small quantities of free carbide is extremely detrimental. While surface finish improves with increase of cutting speed, it is also a function of the graphite flake size—the larger the flake size, the

poorer the finish, Field and Kahles said.

A study of gas inclusions or core blows by A. A. Evans, International Harvester Co., Indianapolis, led to the investigation of flow properties of iron and their effect on casting quality. In a paper, "Fluidity vs. Core Blows in Automotive Gray Iron," he found the core oil content has to be increased to over two per cent before a blow could be induced. Further explorations led to a correlation of data that indicated that there was a definite relationship between rate of solidification and core blows, probably due to trapped gases permeating the hot metal.

Evans described the fluidity test used to set up controls and measure flow characteristics. He also discussed the various testing devices available to foundrymen. Principal use of the tests, he said, is to follow trends, the extent of which can be predicted and chemistry changes made to correct the conditions.

Second gray iron session was held on Thursday morning, May 13. R. A. Flinn, Jr., University of Michigan, Ann Arbor, presided, assisted by H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio, who also presented a paper, "The Theoretical Aspects of Oxygen in Cast Iron" for the author, B. B. Bach, British Cast Iron Research Association, Birmingham, England.

Mr. Bach, in his paper, reviewed some of the basic principles applying to the physical chemistry of cast irons, particularly in reference to the presence and effect of oxygen. The principal components of cast iron—iron, carbon, silicon, manganese and phosphorus—have different affinities for oxygen, dependent on temperature. Physical form of the element must also be considered, Bach said.



W. B. Wallis, Pittsburgh Lectromelt Furnace Corp. (extreme right), president of FEMA, contemplates pipe at organization's reception. With him, from left: V. E. Stine, Pangborn Corp.; F. E. Fisher, consultant; and Mr. and Mrs. A. J. Tuscany, Jr., FEMA.



AFS Director Tom Kaveny, Jr. (left), Herman Pneumatic Machine Co., chats with O. A. Pfaff, American Wheelabrator & Eqpt. Corp.

The Law of Mass Action is the fundamental law underlying the entire structure.

The author expressed equilibrium equations for various structural relationships: Fe-O-(H), Fe-C-O, Fe-Si-O, Fe-Mn-O, Fe-P-O, and Fe-C-Si-O. He purported only to indicate in broad outline the direction in which the reactions are likely to proceed when the conditions are changed. Consideration of oxygen-slag reactions were deliberately omitted because of their relative complexity.

In an attempt to correlate quantitatively the effects of the more prominent variables found in acid cupola operation, S. F. Carter and Ralph Carlson, American Cast Iron Pipe Co., Birmingham, Ala.,

studied coke size and size distribution, coke quantity, air volume, and size and shape of steel scrap. Reporting in their paper, "Some Variables in Acid Cupola Melting," they indicated data taken from 45 experimental heats on a 23-in. cupola. Most of the principles deduced were verified on production cupolas of larger size.

They found that coke size affects all reactions, with best performance when coke size ranged from 8-15 per cent of cupola diameter. Properly sized coke, they said, gave highest temperature, highest carbon, lowest oxidation loss, cleanest tuyeres, least bridging, and most favorable slag composition. Amounts of coke affected all reactions, also, Carter

and Carlson indicated. An optimum range of air volumes was shown, and it was indicated that, where large proportions of steel scrap are used, variations in the type of scrap can cause considerable variations in cupola performance. Change of slag to basic side, and blast conditioning, they maintained, can alter all these relationships markedly.

W. Y. Buchanan, John Lang & Sons, Ltd., Johnstone, Renfrewshire, Scotland, presented his Official Exchange Paper from the Institute of British Foundrymen: "Cupola Melting of Cast Iron Borings and Steel Turnings." This process results in economy of transport of material in and out of the foundry, reduces contaminations through use of borings of known composition, cuts costs, and conserves foundry materials. Use of canisters for borings, cement bonding of steel cuttings, and similar charging methods, were described by Buchanan.

Because of the sudden disruption of the market in 1936, the author experimented with the melting of borings and turnings in a 32-in. cupola. He reviewed the various experimental heats and the indications drawn from them. The ferro-silicon process, using two cupolas mounted vertically, was found to be impracticable in wartime Britain and was abandoned. Other methods attempted included the formation of balls by the freezing of cast iron around steel particles, a product found suitable for ordinary cupola charges.

Buchanan stated that with 20-60 per cent by volume of steel cuttings mixed in cast iron, melting rate and tapping temperature appeared to improve considerably, although the steel itself was varied over a wide range. After outlining the various phases through which work with borings and cuttings in his plant had proceeded, Buchanan concluded that the cupola will melt any ferrous metal, from the full size of the charge door, down to the smallest form of drilling and cutting.



Past Presidents of AFS gathered for their Annual Breakfast during Convention. From left, standing: R. E. Kennedy, Secretary-Emeritus; I. R. Wagner (1952-53); Hyman Bornstein (1937-38); W. B. Wallis (1948-49); F. J. Walls (1945-46); W. L. Moody (1950-51); and L. N. Shannon (1940-41). Seated, from left: R. J. Teeter (1944-45); L. C. Wilson (1943-44); G. H. Clamer (1923-24); C. E. Hoyt, Retired Executive Vice-President; W. L. Seelbach (1951-52), presiding; H. S. Simpson (1941-42); W. R. Bean (1920-22, two terms); B. D. Fuller (1917-18).

R. A. Clark, Electro Metallurgical Co., Detroit, presided at the Thursday afternoon session. G. Vennerholm, Ford Motor Co., Dearborn, Mich., served both as vice-chairman and secretary.

The session featured the presentation of the Official Exchange Paper of the Institute of British Foundrymen, Victoria (Australia) Branch: "Australian Methods of Producing Special Pipes," by G. J. Benson, Melbourne Technical College, Melbourne, Australia. In this era of foundry mechanization, said Benson, founders must not lose sight of the importance of jobbing work, and must continue to train men in this highly specialized art. To illustrate his point, the author described the production of a 48-in. internal diameter faucet tee pipe, tested to withstand 300-ft head of pressure; and a flanged 90-degree bend pipe, 54-in. ID, used for low-pressure pumping systems. The faucet tee pipe is molded by the frame and strickle method.

Benson outlined the use of bearing irons and hold-down plates for molding the pipe. A natural sand of 45 AFS fineness, with 12-15 per cent clay is used. A small amount of organic material, such as saw-dust, is used in the sand to counteract expansion defects and increase the collapsibility of the core and allow the casting to contract.

Strickle boards are eliminated in casting the second type of pipe, substituting a shell skeleton pattern. Cost of production is high and unless volume is sufficient, competition from fabricated sections is likely to be keen in Australia, Benson pointed out.

Jules Henry, Forest City Foundries, Cleveland, presented a paper on "Importance of Cooling Rate on Physical Properties of Gray Cast Irons." Cooling rate, he declared, has not received the attention it warrants as one of those most important physical factors concerned in the casting of gray iron. He discussed only the cooling rate through the lower critical temperature.

Henry reported tests on the effect of cooling rate on hardness and tensile strength. His investigations seemed to indicate that both strength and hardness of gray iron are increased by shaking out castings while they are above the austenite-pearlite transformation temperature. Section size is widely used as an estimate of physical properties that might be expected in castings, Henry said, but intelligent application of data on cooling rate enables the foundryman to work with chills and hot shakeout in controlling cooling in complex shapes.

R. C. Shnay and S. L. Gertsman, Department of Mines and Technical Surveys, Ottawa, Ont., Canada, having found little specific data in the literature on the shrinkage of nodular iron, sought to determine empirical relationships in this area. In their paper, "Rising of Nodular Iron," the authors reported that they early found center-line shrinkage remote from the riser, and gross or spongy shrinkage under or immediately adjacent to the risers, were separate problems. Since a sound casting can only be produced when both problems are



Many foundrymen visited the Ford Motor Co. Cleveland Foundry on Friday, May 14.

solved, Shnay and Gertsman dealt with both phases in their paper.

A simple rule of thumb for riser heights, such as is used in steel, cannot be successfully formulated for nodular iron, they stated. Their work showed that riser diameter had to be greater than twice the plate thickness for effective range of feeder distance. On the basis of their investigations, they maintained that nodular iron does require risers approaching those used for steel castings.

Gray Iron Research Progress Report No. 5, "Rising of Gray Iron Castings," by W. Schmidt, E. Sullivan, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, was also presented at the session. Covering the 1953 period, the authors indicated developments in their studies of shrinkage defects, showing close correlation of shrinkage volume with swelling of castings.

A stable mold is necessary to obtain meaningful and reproducible results, Schmidt, Sullivan, and Taylor said. Their development program included exploration of the effects of mold material, gases in iron, and solidified casting contours. Gases in iron were demonstrated to cause abnormal variations in shrinkage.

After three years, the authors stated that an apparatus and a technique of investigation have been perfected which will lead directly to accurate analysis of the rising of gray iron to control shrinkage in feeding.

Three papers were presented at the second Thursday afternoon Gray Iron session. Chairman was H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio; vice-chairman and secretary: C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

"Graphitization of Mg-Treated White Iron," was the title of a paper presented by C. M. Hammond, University of Michigan, Ann Arbor. Co-authors were F. J. Walls, International Nickel Co., New York; W. B. Pierce, University of Michigan; and R. A. Flinn, University of Michigan.

Under carefully controlled conditions, calcium carbide will desulphurize gray iron efficiently, said H. E. Henderson, Lynchburg (Va.) Foundry Co., and J. M. Crockett, Air Reduction Sales Co., New York. Their paper, "Calcium Carbide Injection—A New Tool for the Foundryman," described various attempts to successfully inject calcium carbide. The most consistent results have been obtained with a carrier-gas stream for injecting the solid calcium carbide into liquid iron.

Sulphur can be reduced to any desired level with this method, Crockett and Henderson reported. They divided the process into four fields: desulphurizing from 0.10-0.20 per cent down to 0.07-0.08 per cent sulphur, where 10 lb injected calcium carbide will remove 1 lb sulphur; desulphurizing down to less than 0.02 per cent, allowing use of more economical alloying additions; reduction under 0.02 per cent as a base metal for conversion to spheroidal graphite cast iron; and use of the process to upgrade physical properties and to spheroidize.

"Alloying and Heat Treating Spherulitic Graphite Cast Iron" was the title of a paper presented by C. C. Reynolds and H. F. Taylor, Massachusetts Institute of Technology, Cambridge. They discussed the mechanical properties of alloyed spherulitic irons in the as-cast and heat-treated conditions. Reynolds and Taylor

reported on investigations into quenching and tempering, and the effects of elements and various standard heat treating procedures.

Carbon and silicon, they said, have the greatest effect on size and number of graphite spherulites of the tested elements. Raising the carbon equivalent decreases size, increases number of spherulites. Alloy content, they continued, has relatively little effect on pearlitic microstructure, but markedly affects the amount of pearlite present. Increasing section size reduces pearlite and gross carbides when present.

Reynolds and Taylor described their experimental procedure in the work that was originally performed for Watertown Arsenal. They discussed the effects of alloys on gray iron characteristics, then outlined results obtained with heat treating in various tests.

Final gray iron technical session was held on Friday, May 14, with A. E. Schuh, U. S. Pipe & Foundry Co., Bur-

lington, N. J., presiding. T. W. Curry, Lynchburg (Va.) Foundry Co., acted as vice-chairman and secretary.

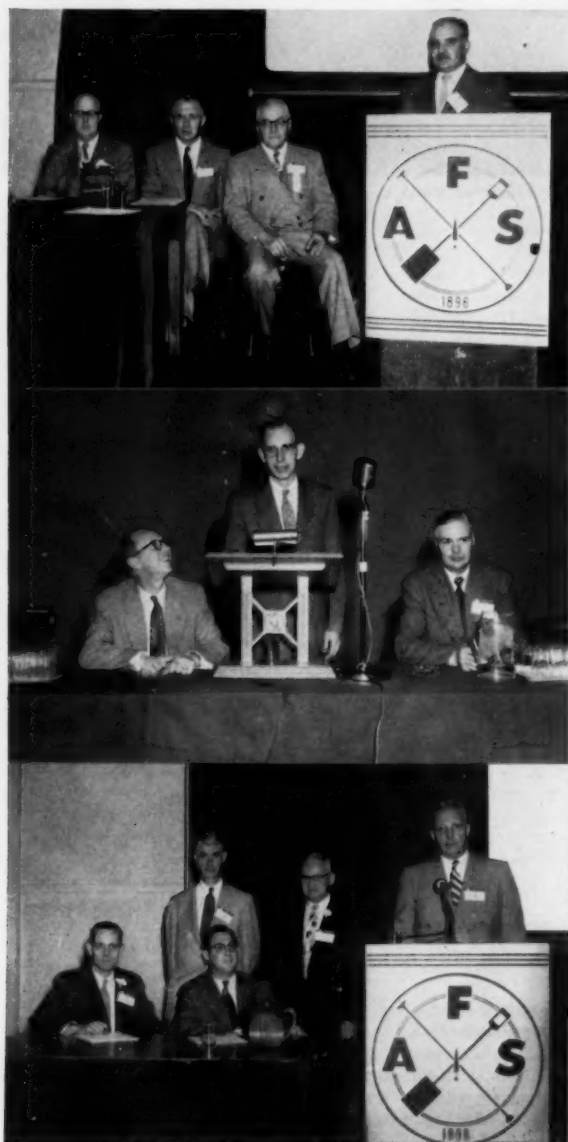
R. W. Lindsay, Pennsylvania State University, State College, Pa., and J. H. Hoke, Johns Hopkins University, Baltimore, Md., collaborated on the first paper: "Effect of Graphite Flake Size Upon the Tensile and Fatigue Properties of Gray Cast Iron." Their experiments showed that increase in size of graphite flakes caused a decrease of tensile strength and endurance: 25 per cent and 35 per cent, respectively. When the diameter of castings was increased from one inch to three inches, Lindsay and Hoke said, the flake size increased pronouncedly. Further increase of flake size was gradual for castings over three inches in diameter.

Flake size is probably somewhat more important in fatigue strength than in tensile strength, they stated. This condition results because the surface of the specimen is more critical in the fatigue tests, while the entire cross-sectional area

is important in the tensile test, they said.

W. C. Jeffery, E. E. Langner, Jr., W. G. Mitchell, and G. D. Azizi, all of the University of Alabama, collaborated on the paper, "Relationship of the Carbon Equivalent to the Properties of Cast Iron." Their work was predicated on the fact that southern foundry pig iron contains about 0.80 per cent phosphorus, compared with 0.25 per cent in the north. Carbon equivalent, said the authors, is the formula generally used in the foundry to define how close an iron is to its theoretical eutectic composition. It was selected by the authors as a logical approach for establishing a relationship between the properties of cast iron and the chemical composition.

They described their test procedures in working with shrinkage, fluidity, hardness, chill, transverse specimens, and drill test machinability. According to the writers, their investigations showed that the carbon equivalent has a sufficiently valid relationship with the major prop-



(Upper Left) I. R. Kramer, Mercast Corp., at podium during Pattern Session. Seated, from left: J. W. Costello, American Hoist & Derrick Co.; R. E. Wendi, Industrial Pattern & Mfg. Co., Inc.; and E. T. Kindt, Kindt-Collins Co. (Left Center) W. W. Holden (center), Eaton Mfg. Co., led discussion at Gray Iron Shop Course. H. W. Wilder (left), Vanadium Corp. of America; and E. J. Burke, Hanna Furnace Co., participated. (Bottom Left) At this Sand Session, J. H. Lansing, Malleable Founders Society, (standing at podium), presided. Others standing, W. G. Parker (left), General Electric Co.; and R. A. Loder, Erie Malleable Iron Co. Seated, from left: F. P. Goettman, Standard Sand Co.; and C. F. Quest, J. F. Quest Foundry Co. (Upper Right) Reminiscing about old times at the Alumni Dinner, from left: B. D. Fuller (Past-President 1917-18); C. E. Hoyt, Retired Executive Vice-President; H. S. Simpson (1941-42); V. E. Minich; and G. H. Clamer (Past-President 1923-24). (Bottom Right) Shown at Board Meeting Luncheon, from left: C. V. Nass, Beardsley & Piper Div., Pettibone-Mulliken Corp.; C. B. Schneible, Claude B. Schneible Co.; H. F. Scobie, editor, American Foundryman; E. C. Hoenicke, Eaton Mfg. Co.; and J. O. Klein, Texas Foundries, Inc.

erties of cast iron to be used as an approximate formula for estimating those properties from chemical composition. They reported that tensile strength decreases as the carbon equivalent increases; that at a carbon equivalent value of approximately 3.7, the transverse strength is at a maximum; that as the equivalent value increases, the hardness of a given section decreases; and that, for a given iron, hardness increases as section size decreases. Internal shrinkage increases as both carbon equivalent and phosphorus content increase, and the graphite flake size increases as the carbon value increases. Finally, the authors reported, machinability of cast iron also increases in direct proportion to carbon equivalent values.

Where graphite, ferrite, and TiC are the phases present after heat treatment, work with Fe-C-Ti alloys showed that titanium promoted equilibrium structures. This conclusion was reached by A. B. Beach, General Electric Co. and University of Wisconsin, and R. W. Heine, University of Wisconsin, Madison, in their paper, "Graphitization of Certain Fe-C-Ti Alloys." The authors undertook a study of certain Fe-C-Ti alloys to determine the nature of the stable Fe-C-Ti-Fe system, and the alloying behavior of titanium in Fe-C alloys having a carbon percentage in the range of cast irons.

Their work indicated that titanium apparently has greater affinity for sulphur than has iron. They used a heat treatment of the type used on malleable irons to test the influence of titanium on graphitization. Beach and Heine concluded that titanium promotes graphite nucleation and graphitization in iron-carbide alloys where it would not otherwise occur. The alloying behavior of titanium, they said, shows that it is not necessary for an element to dissolve in ferrite in order to promote graphitization of iron carbide in ternary iron-carbon alloys.

First of the Gray Iron Shop Courses was held Monday evening, May 10. H. H. Wilder, Vanadium Corp. of America, Detroit, presided; E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y. assisted. General subject for the meeting was "Coke Screening and its Relation to Cupola Operation."

Moderator for the evening was W. W. Holden, Eaton Mfg. Co., Vassar, Mich., who opened the session by describing coke handling at his plant. Using color slides, Holden pointed out that careful handling will keep coke in good condition and raise the efficiency of the melt operation. Since, Holden said, coke affects the permeability of the bed, the gas flow, and increases burnout, it is important that the foundryman use every means to get the maximum from his cupola insofar as the coke is concerned, in addition to other factors.

The diameter of the cupola should not be the only factor concerned in the selection of coke size. Large coke, said Holden, can cause excess oxidation, and result in greater carbon content because of the increased area of carbonation in the cupola. Coke screening has been found to



AFS President Collins L. Carter (second from right) passes along an amusing story. Listening, from left: Bruce L. Simpson, new AFS Vice-President; Frank J. Dost, new AFS President; W. L. Seelbach; W. L. Woody; and AFS Secretary-Treasurer Wm. W. Maloney (far right).



The Canadian Dinner was the scene for reunions like this. From left: Mrs. and Mr. J. A. Dickson, Dickson Foundry Co., Past-Chairman, British Columbia Chapter; Mrs. and Mr. J. G. Hunt, Dominion Engineering Works, Ltd., Chairman, Eastern Canada Chapter; and Mrs. and Mr. Alex Pirrie, Standard Sanitary & Dominion Radiator, Ltd., Chairman, Ontario Chapter.

increase the ratio of metal to coke, and produce a higher heat with less blast and pressure. All these advantages, stated Holden, accrue with less cost in coke, and the use of less limestone.

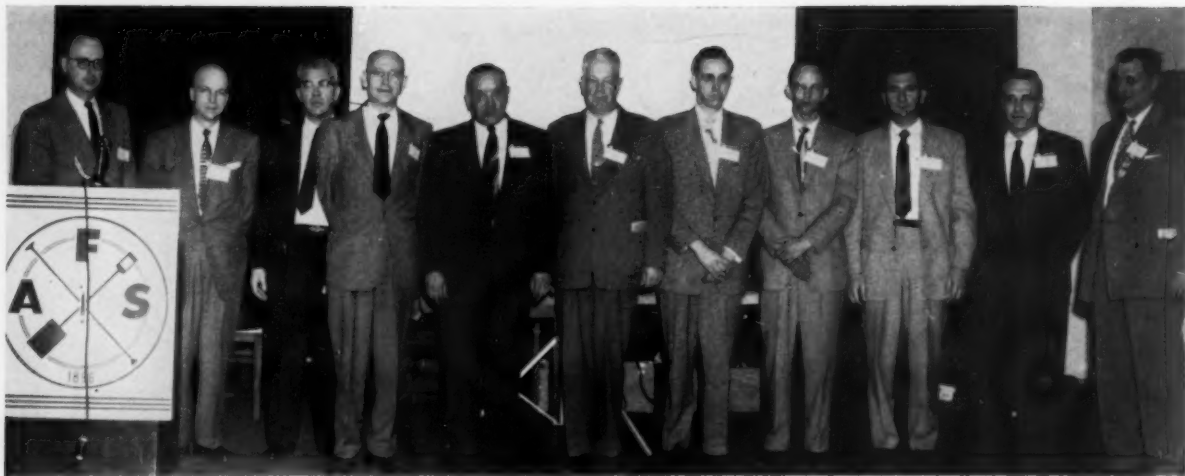
K. H. Priestley, Vassar Electroly Products, Inc., Vassar, Mich., presided at the second Gray Iron Shop Course on Tuesday evening. He was assisted by Vice-Chairman L. L. Clark, Armour Research Foundation, Chicago. Discussion leader was F. J. McDonald, Central Foundry Div., General Motors Corp., Saginaw, Mich.

Subject for the discussion was, "Gating to Control Pouring Rate and its Effect on Casting Quality." Mr. McDonald reviewed the inter-relationship between pouring rate and quality of castings, with reference to gating systems in common

use. The consensus among the audience was that considerable malleable practice is being adopted in gray iron foundries, and that moving the choke from the ingate has improved the soundness of castings. It was suggested that using a pouring box with a dam will assist in standardizing conditions, a prerequisite for consistent reproducibility in production runs.

A difference of opinion arose as to whether the runner should be located in the drag, with the gating in the cope. Pouring height was discussed at length. One member of the audience reported that inverting the sprue so that the smaller opening is at the top will allow faster runoff.

Last of the Gray Iron Shop Courses was held on Thursday evening, D. E.



At the Dust Control and Ventilation Session Tuesday afternoon, from left to right: R. S. Dahmer, Foundry Div., Eaton Mfg. Co.; A. S. Lundy, Claude B. Schneible Co.; J. G. Uskow, American Air Filter Co.; F. C. Fluegge, Industrial Engrg. & Construction Dept., International Harvester Co.; T. J. Glaza, Crane Co.; J. R. Allan, Inter-

national Harvester Co.; Albert Edwards, American Brake Shoe Co.; W. W. Dodge, Plant Engrg. Dept., Caterpillar Tractor Co.; B. B. Bloomfield, Div. of Occupational Health, Michigan Department of Health; K. M. Smith, Caterpillar Tractor Co., and W. N. Davis, Director, Safety, Hygiene and Air Pollution.

Matthieu, Alabama Pipe Co., Anniston, Ala., led the discussion with a paper on "Cupola Bed Practice." Presiding at the meeting was W. W. Levi, Lynchburg (Va.) Foundry Co. W. W. Holden, Eaton Mfg. Co., Vassar, Mich., was vice-chairman.

Mr. Matthieu said that lack of attention to preparation of the cupola bed is one of the most harmful practices in present foundry operations. You can't produce sound, clean, salable castings, he said, with bad metal. Since preparation, height, and burning-in of the coke bed are among the most critical items in the operation of a cupola, any effort to economize on these phases without careful planning may lead to costly melting difficulties.

Matthieu described eight common methods of igniting the coke bed. Caution

must be exercised, he warned, since it is a rare occasion when a poorly prepared and burned-in bed can be corrected during the course of a day's heat. Better to delay the operation in the beginning. Choosing bed height and checking on performance were also included in his review. Concluding, Matthieu said that the best asset any melting department can have is a conscientious supervisor with the knowledge and intelligence to recognize minor variations and trends as they occur, and the initiative and know-how to correct them before they become serious.

The Gray Iron Round Table Luncheon was held on Wednesday noon at the Hotel Statler, with J. S. Vanick, International Nickel Co., New York, in the chair. Vice-chairman for the meeting was C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

L. N. Shannon, Stockham Valves & Fittings, Inc., Birmingham, Ala., a Past-President of AFS and 1953 President of the International Committee of Technical Organizations, spoke on "High Lights of Our European Trip." He reviewed the events at the 1953 International Foundry Congress at Paris, where he presided, and the European tour that followed. He found much obsolete equipment in French foundries, many of which were partly owned by the government. Much bronze is cast in Italy, probably in keeping with that country's rich art traditions. Most modern foundries he saw in Europe, said Shannon, were the Swiss, where many Germans are working. He described the rapid advancements being made in the Ruhr region, and concluded that European foundrymen are generally fine craftsmen with great pride in their work.

Second speaker was J. E. Rehder, Canada Iron Foundries, Ltd., Montreal, whose subject was, "European Metallurgy and Melting Practice." His talk was also based on the 1953 European tour. Rehder said that European ores are poor, with a maximum of about 30 per cent iron. Coal

contains high sulphur and coke is scarce on the Continent, he said. He described a typical French foundry, which used up to 70 per cent steel scrap in the furnace.

F. M. Kulka, Motor Castings Co., Milwaukee, was the final speaker. "European Molding, Core Making, and Production Equipment," was the topic he chose. Kulka felt that there has been a mechanical reawakening in Europe on shops. He briefly described several foundries he visited, where he found production to be low, but quality of a generally good character.

SAND

THE Sand Division sponsored a program lasting throughout the week, and including six regular sessions, three Shop Courses, and a Round Table Luncheon. Major developments in foundry sand practice were thoroughly explored at these meetings.

E. L. Buchman, Ford Motor Co. Cleveland Foundry, presided at the Wednesday afternoon session, assisted by Vice-Chairman and Secretary T. Giszczak, Central Foundry Div., General Motors Corp., Defiance, Ohio. B. H. Booth, Carpenter Bros., Inc., Milwaukee, and C. A. Sanders, American Colloid Co., Chicago, collaborated on a paper: "Another Look at Sand Grain Distribution."

The salesman furnishing molding sand exercised the only control over the product until 1920, they said. Booth and Sanders pointed out the early work of Dr. Richard Moldenke in sand control, then traced progress in the field through the 1920s and later. First methods of grain distribution classification were ambiguous, the authors stated, although AFA Grain Distribution specifications were still the tentative standards.

Mechanical properties of molding sands can be influenced to a consider-



This trio met at Alumni Dinner. From left: F. M. Wittingler, Texas Electric Steel Casting Co.; I. R. Wagner, Electric Steel Castings Co.; and Dr. J. T. MacKenzie, American Cast Iron Pipe Co.

able extent by alteration in grain distribution, the co-authors continued. Distribution is easily changed where several sands are being blended in one foundry. Booth and Sanders described the method of determining AFS Grain Fineness Number, and also discussed confusion in terminology that exists within the foundry industry. The actual screen analysis of the sand, they maintained, is the basic test, and plotting and visual analysis with actual screen tests should be used by all laboratories seeking scientific information. They concluded that the "number-of-screens" designation is not sufficiently precise to deserve definition, although the term is descriptive in a rough way. A satisfactory explanation of grading sand grain distribution is necessary, particularly if foundrymen are to speak the same language.

While many superficial changes have been made in the foundry industry, and particularly in sand equipment and materials fields, the basic fundamentals have remained much the same, according to L. L. Clark, Armour Research Foundation, Chicago. In his paper, "*Fundamentals Make Better Castings*," Clark traced the various phases through which the industry has passed in recent years. The most basic fundamental, he said, is the preparation of molding sand, which should be the responsibility of one man. Accurate weighing and compounding of mixtures is essential, and moisture control is mandatory; indeed, it appears to be the one most important step.

Clark discussed correlation of casting finish with various types of screen distribution curves. Varying particle sizes will cure excess penetration, he said, requiring use of proper size screens. He also reviewed the principles involved in the use of bonds, with particular reference to green and hot strength. The general consensus now is that a blend of clays is more desirable than single type, Clark declared. He also pointed out the advantages of natural and synthetic sands, and stressed the need for prudence in making a choice. All of the factors entering into the economics of the specific operation must be considered.

R. W. Bennett, Walter Gerlinger, Inc., Milwaukee, presented the Official Exchange Paper from the Institute of Australian Foundrymen, New South Wales Div., written by Paul Markwell, McLean Castings, Ltd., Sydney.

Entitled, "*Zircon Sands—Occurrence and Uses in Australian Industry*," the paper opened with an historical summary of the mining of zircon sands in Queensland and New South Wales. Zirconium itself does not occur free in nature, but is found as a component of complex silicates. Markwell, in his paper, was concerned only with the silicate of zirconium. He showed the characteristics of the mineral and delineated the methods of separating rutile and zircon by electrostatic and floatation processes.

Zircon has high refractory value, said Markwell, the principal reason why it is finding increasing favor as a molding



Sand Round Table Luncheon attracted large group of foundrymen. At speakers' table, from left, standing: E. C. Zirzow, Werner G. Smith, Inc.; C. A. Sanders, American Colloid Co.; R. H. Olmsted, Whitehead Bros. Co.; W. R. Maggridge, Ford Motor Co. of Canada; C. C. Sigerfoos, Michigan State College; H. W. Dietert, Harry W. Dietert Co.; and B. H. Booth, Carpenter Bros., Inc. Seated, from left: F. S. Brewster, president, Harry W. Dietert Co.; H. J. Heine, AFS Technical Director; O. J. Myers, Vice-Chairman, Archer-Daniels-Midland Co.; H. W. Meyer, General Steel Castings Corp.; C. E. Wenninger, National Engineering Co.; G. J. Grott, Unicast Corp.; and M. H. Horton, Deere & Co.

sand and a mold coating. It has a much higher melting point than the temperatures found in the worst hot spots, and fused core and mold surfaces are entirely eliminated by its use. It has, he claimed, about double the heat conductivity and density of silica sand, allowing it to absorb twice the heat, twice as fast, with about four times the heat dissipation or cooling rate. It has less than one-third the expansion of silica and is not wetted by molten metal. Zircon sands require less binding materials than are normally used, Markwell said. He concluded that zircon sands have advantages that far outweigh the disadvantages, but caution must be exercised in its use.

The use of pH measurements to control chemical additions to molding sands is an economical means for minimizing variations in performance and attaining a high level of casting quality, said V. E. Zang and G. J. Grott, Unicast Corp., Toledo, Ohio, in their paper: "*Casting Quality as Related to pH Value of Molding Sands*." They described use

of pH measurements in interpretation of experiments with soda ash and cereal in test molds.

Molding sand mixtures, Zang and Grott stated, are composed of small particles—sand grains and colloidal materials. Consideration of the properties of these particles are requisite to effective sand control. Clay is the most important colloid present and its behavior may be controlled with the use of chemicals. Bonding action of clays is influenced by changing the degree of hydration, strength of the bond, and the geometrical orientation of the clay particles.

The pH of a sand mixture changes at a rate largely determined by the decomposition of organic materials, the authors said. Because of the number of variables, experiments with simple mixtures may be necessary to ascertain optimum values, dependent upon type of castings being produced. No high degree of skill and no special equipment is necessary, other than some means for measurement of pH value, they stated.



The Administrative Council of National Foundry Association met at Cleveland. Shown, standing, from left: A. G. Hall, Nordberg Mfg. Co.; A. V. Martens, Pekin Foundry & Mfg. Co.; R. R. Washburn, Plainville Casting Co.; P. L. Arnold, U. S. Pipe & Foundry Co.; L. N. Essex, Golden Foundry Co.; H. M. Greenbaum, Acme Foundry Corp.; and F. D. O'Neil, Western Foundry Co. Seated, from left: F. W. Busche, General Foundries Co.; C. T. Sheehan, NFA executive secretary; W. Summerfield Brunk, NFA president; W. W. C. Ball, vice-president, NFA; and R. F. Heiden, Galva Foundry Co. Meeting was held at Hotel Cleveland.



AFS Headquarters booth was focal point for activities during the Convention week.

At the same session, held on Wednesday afternoon, May 12, C. E. Wenninger, National Engineering Co., Chicago, presented a paper, "What Is Basic to the Selection and Mulling of Synthetic Sands?" John Perkins, Ford Motor Co. of Canada, Ltd., Windsor, Ont., presided, and F. W. Jacobs, Texas Foundries, Inc., Lufkin, Texas, was vice-chairman. J. S. Schumacher, Hill & Griffith Co., Cincinnati, served as secretary.

Mr. Wenninger stated his hypothesis: that ceramic science and the foundry art should be linked in refractory usage. Emphasis on four-sieve distributions, he said, indicated a ceramic concept for orderly packing might be applicable to explaining the characteristics of such sands. Foundrymen have traditionally considered prepared sands as individual grains coated with bond, rather than in terms of orderly packing of aggregate particles.

The newer (to the foundrymen) concept of the ceramist is that orderly packing is not established within a mold by ramming, but that it is achieved through a dynamic grouping and packing of compatible particle sizes during mulling. Promotion of such packing, Wenninger claimed, will contribute to potential increase in density, stability, bond efficiency, and strength. A mixture of base sand, bonds, and moisture must be mulled, he pointed out, until it is predominantly composed of orderly formations or colonies. The more thorough the mulling, the greater the degree to which orderly formations will be established, reflected by the superior physical characteristics resulting in properly rammed cores and molds.

Burdette Jones, John Deere Waterloo Tractor Works, Waterloo, Iowa, presented a paper on "Pre-Mixing of Reconditioning Materials for Molding Sand." Describing the mechanization of the John Deere Waterloo works, Jones said that the pre-mixing of sand additives has resulted in definite savings in

materials, better control of sand properties, and a cleaner sand conditioning department. Experiments were predicated on the assumption that bond in the sand was destroyed simultaneously with a proportional amount of the carbonaceous material. With proper ratio of bond and carbonaceous material and constant molding conditions on the unit, it would only be necessary to keep green strength constant to produce a constant loss on ignition. Control of the pre-mix would, Jones said, provide this determinant factor.

Changes in the mixer and formula were made over a wide range, with one man preparing the pre-mix. Results indicated that savings in materials alone more than pay for the cost of pre-mixing, he stated, in addition to the other advantages.

The Thursday morning sand session was presided over by C. E. Maddick, Massey-Harris Co., Ltd., Brantford, Ont., Canada. C. W. Schwenn, Brillion Iron Works, Inc., Brillion, Wis., was vice-chairman, and R. G. Reiff, Ford Motor Co., Dearborn, Mich., served as secretary.

Shell molding, now about three years old, has had tremendous impact on the foundry industry, said E. I. Valyi, A.R.D. Corp., Yonkers, N. Y. in his paper, "Recent Developments in Shell Molding." Improvements and developments have been constant and it is now possible to obtain some perspective in reviewing the process as a metals casting tool.

Increased value content—which results from improved surface finish, greater accuracy, greater potential complexity, and reduced machining requirements—has real value only if rewarded by the buying public. And, he pointed out, these advantages will have to be accomplished at equal or lower cost than current good green sand practice. The principal purpose of shell molding, according to Valyi, is reduction of the cost of the casting to the foundryman first.

Largest single item in cost is the binder and recent experiments have brought down the sand-resin blend to approximately 1.8 cents per lb. Coated sands provide probably the most important field for advancement in shell molding today, Valyi stated. He said that use of these sands will improve the economics of the process and make possible certain means of mold and core production, air conveying, and other operations not possible with dry blends.

Next to proper sand application, he continued, the most critical aspect of shell molding is temperature control in the pattern, and the maintenance of necessary heat without loss of time and extension of the molding cycle.

Valyi concluded his review with the prediction that improvements now in the making in shell molding, through use of more evenly distributed, lower cost binders and reduced time cycles for molding and core making, will bring shell molding to levels far above the economy of current foundry practice.

"Pressure Molding with Standard Synthetic Sand," was the title of a paper delivered at the same session by T. E. Barlow and W. R. Adams, Eastern Clay Products Div., International Minerals & Chemical Corp., Chicago. They outlined the basic concepts of pressure molding, reported results in commercial service, and reviewed preliminary studies of ordinary materials at elevated squeeze pressures.

Precision results from high pressure molding are entirely possible, said the authors, if both the sand properties and the equipment are considered in proper relationship. Laboratory work indicates that "precision" is obtainable by improving sand flowability, increasing molding squeeze pressures, or by special molding equipment, such as diaphragm or contour units.

Commercial castings are being produced at 100-psi squeeze pressures, with special high pressure sands for close tolerances. Work reported in the paper was designed to determine whether ordinary molding sands would react to pressure in the same way. In no case, they said, was there marked indication that change to high pressure squeeze made a major alteration in casting appearance or dimensional stability. Chemically-treated-cellulose sand with 100-psi squeeze pressure produced the best results and should be studied further.

Sand fineness, according to Adams and Barlow, should have a direct bearing on casting finish. However, increase of fineness may reduce flowability to the extent that finish is actually impaired. If flowability is retained, fine sand is desirable to obtain good finish at lower molding pressures. Increasing molding pressures, Barlow and Adams concluded, can progressively offset necessity for fine sand, leaving the choice between higher pressure and finer sand for maximum finish and precision as a matter of the immediate economy.

R. G. Powell, C. M. Adams, Jr., and H. F. Taylor, all of Massachusetts Institute of Technology, Cambridge, col-



Annual dinner meeting of the Non-Ferrous Founders' Society held May 10 in conjunction with the 1954 AFS Convention and Exhibit honored the outgoing president, R. L. Langsenkamp, Langsenkamp-Wheeler Brass Works, Indianapolis, and greeted the incoming

officials. They are H. A. White, Smith-Harwood Co., Chicago, president; W. L. Leopold, Northern Bronze Co., Philadelphia, first vice-president; and E. J. Metzger, Multi-Cast Corp., Wauseon, Ohio. James W. Wolfe continues as executive secretary.

laborated on a paper entitled, "Research on Shell Molding," which was presented at the same session. Judicious choice of a resin may result in substantial saving of binder because of the wide variation in bonding efficiency among the several proprietary phenolic resins sold for shell molding, they said. Maximum bonding efficiency can be promoted by proper curing of shell molds, Powell, Adams, and Taylor declared. The coarsest sand which still produces satisfactory results on castings should be used, the authors maintained, because surface coating consumes substantial amounts of binder without contributing much to strength.

Cleanliness of sand is an important factor in resin consumption. Sand grain angularity will contribute to wasteful binder consumption, they continued, because surface area is increased and density of sand packing in shell molds is decreased. Well-rounded grains are the most desirable for shell molding processes. Their preliminary studies have indicated that resin consumption might be reduced as much as 50 per cent by special methods of mechanical sand packing.

Primary among the causes for high resin consumption, they claimed, was poor adhesion of resin to sand, causing fracture at the interface. Their investigations showed that clean zircon sands produce much stronger shell molds than silica, probably because of higher affinity of resin for zircon. They predicted that hydrogen bonding may prove to be an effective process in shell molding.

With C. F. Walton, Case Institute of Technology, Cleveland, presiding; W. D. Lawther, American Steel Foundries, East St. Louis, Ill., acting as vice-chairman; and R. H. Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich., serving as secretary, the Thursday afternoon session featured three papers.

"Core Blowing Problems" were discussed by J. A. Mescher, Unitcast Corp., Toledo, Ohio, who wrote his paper primarily for the small and medium-sized foundries that have encountered troubles with core blowing machinery. Core quality, maintenance of boxes, reduction of setup time, and high speed production were cited as the principal sources of problems. Mescher described the operation of a typical blow machine, with operating details.

Uniform hardness is necessary in a blown core, he stated. Under-venting a box may cause soft cores, and reinforcing rods may be needed. Mescher said that cleanliness is most important in maintenance of boxes. Where blown cores do not require special driers, high speed production may be accomplished by using two men with duplicate boxes on the same machine, at the same time. The author illustrated several types of core blowing machines that have been favorably received in recent years.

W. H. Buell, Aristo Corp., Detroit, reported on work by a sub-committee of the AFS Core Test Committee in a paper: "What Is Stickiness in Core Sand Mixtures?" Relative quantity of core sand retained on the pattern, force required to part the core from the pattern surface, and core smoothness were taken by the committee as methods for measuring stickiness.

Stickiness, Buell said, is related to each of the components in a core sand mixture, and to the mechanism used for blowing or ramming the core, including design of core box, material from which it is made, and condition of its surface. The problem is complicated, he asserted, since a good core sand binder should be a good adhesive, yet it must not stick to the core box. The theory, then, requires maximum cohesion and minimum adhesion.

Buell reported results obtained with the retained sand method of measuring stickiness, and the parting force method. Generally, he maintained, it is conceded that stickiness increases with moisture in typical core sand mixtures. Stickiness has been encountered in the "D" process, and is more likely to occur when sand is blown than when it is rammed by hand. Stickiness, according to the author, cannot be eliminated without regard to other sand properties. Spot tests or the comparison of one mixture with another rarely provide an optimum result. Curves, showing all possible combinations within reasonable limits, are the shortest road to learning. The man who knows everything about core sand practice is not around the corner, Buell concluded, but improvement is within the grasp of a given foundry.

The addition of olivine to silica sand results in a fusion point lower than that of silica, and the reverse is also true, said W. A. Snyder and G. S. Schaller, University of Washington, Seattle, in a paper: "Olivine-Silica Molding Sands." Either condition will lead to defective castings in steel because of the necessarily high pouring temperatures.

Schaller and Snyder reported on investigations going beyond this basic supposition in the behavior of olivine facings, and olivine-silica facings on silica sand molds in steel foundries. After a series of test castings had been produced, they concluded that olivine flour can be successfully used for controlling the properties of silica-based synthetic sands. Additions of up to 20 per cent olivine still retained a fusion point sufficiently high to pour large steel castings. The authors predicted that the cost of cleaning large castings might be reduced through the use of olivine flour, but additional experiments are needed for conclusive results. One trend, they said,

was the tendency for sands with olivine flour to show less sensitivity to moisture variations than sands with silica flour. In general, Schaller and Snyder indicated, results of their studies show that olivine has characteristics that might well lead to its wide adoption by the steel casting industry.

J. H. Lansing, Malleable Founders' Society, Cleveland, was chairman of the second afternoon session on May 13. Vice-chairman was C. F. Quest, J. F. Quest Foundry Co., Minneapolis; secretary, F. P. Goettman, Standard Sand Co., Grand Haven, Mich. The program consisted of three papers.

R. A. Loder, Erie Malleable Iron Co., Erie, Pa., described a "Method of Establishing Standards for As-Cast Surfaces," calling duplication of results an important problem in a jobbing foundry. Although many foundries use job record systems, the description of finish is still subject to erroneous interpretation. Reproduction of an acceptable finish, Loder said, is vital since it is the feature most apparent to the customer and user of the end product. In seeking a reasonably invariable medium of comparison for finishes, the author had sandpaper surfaces cast in various grades on aluminum blocks for visual comparison with casting surfaces. These blocks provided a simple, reliable method for identifying the finish on a casting, and facilitated the permanent recording of that finish. Thus, Loder reported, guesswork and arguments are eliminated and the customer is assured of a minimum of variations in casting finish. Also, the foundry is spared the cost of returned and scrapped castings and the added expense of producing a finish that in some cases might be necessarily better than is required for the given job. If appropriate grades of sandpaper are used, unlimited flexibility of adaptation to the surface standards of any foundry is achieved.

W. G. Parker, General Electric Co., Elmira, N. Y., presented a paper on: "Improving Surface Finish on Gray Iron Castings." He described work with wood master patterns, oil-sand cores, and green molding sand to achieve surface finish requiring a minimum of finishing, and closer adherence to tolerances. Perhaps the foremost factor in producing desirable surface finish is grain size. Expansion and contraction of molding sand also had to be considered, Parker declared. In all his work, he attempted to maintain total deformation in the low 20s, and, at the same time, select the type and amount of bond that would give the desired plasticity with the minimum moisture content.

Parker said that gray iron castings can be made by conventional methods, using either oil-sand cores or green molding sand mixtures, and produce smooth surface finish and close dimensional tolerances. Grain size and distribution of the so-called fine sands should be the chief consideration in selecting sands to be used, he stated. Use of finer sands will produce those refinements of casting finish and closer dimensional tolerances.

Use of green sand molds offers more

economy and adaptability than any other casting method, according to D. C. Ekey and J. E. Goldress, Pennsylvania State University, State College, Pa. In a paper, "Statistical Analysis of Factors Affecting Casting Finish," the authors also stated that this very economy and adaptability are, in some respects, the greatest liability of green sand molding as a process. An almost infinite number of combinations of sand, bentonite, and water are possible, but not all of them will produce good green sand castings. The "right" combination is usually determined empirically at present, they stated. Their paper had as its purpose the study of several variables to determine which significantly affect surface finish of green sand castings.

Four principal factors expected to affect surface roughness were studied: sand fineness, mold hardness, metal pressure, and wood flour. With all other elements held constant, these components were varied for experimental purposes, using new aluminum alloy pig.

In general, Ekey and Goldress concluded that sand fineness has a distinct effect on surface roughness, that metal pressure has a significant effect, but that there is no reason to suspect that wood flour has any demonstrable effect. They called for further study of these significant variables, with particular reference to their interactions.

Final Sand session was held on Friday, May 14, with C. C. Sigerfoos, Michigan State College, East Lansing, presiding; D. C. Williams, Ohio State University, Columbus, as vice-chairman; and D. S. Eppelsheimer, Missouri School of Mines, Rolla, acting as secretary.

In a paper: "Effect of Moisture Content on Silica Sand," E. D. Sayre, General Electric Co., Cincinnati, and C. T. Marek, Purdue University, Lafayette, Ind., explored the effect of moisture on bulk density, hardness and green compressive strength of silica sands. The goal was to find means of producing sands scientifically designed to fit specific casting jobs, with higher quality, greater efficiency, less waste, and lower cost than present techniques afford.

Sayre and Marek determined that sand bulk density decreases to a minimum as water is added, then increases, approaching a maximum near the point of inundation. Hardness and compressive strength increase accordingly, and approach a constant maximum as moisture content increases. In correlation with decrease in grain size, they said, the minimum bulk density drops and a greater maximum strength and hardness develops.

Several theories of water bonding were discussed, with Sayre and Marek proposing their own theory of change in bulk density, compressive strength, and hardness of pure silica sand and water mixtures, in terms of positive charges on sand grains attracting negative hydroxyl ions.

R. G. Thorpe, O. P. Eberlein, R. C. Waugh, and P. E. Kyle, all of Cornell University, Ithaca, N. Y., presented the thirteenth progress report on the sand research project being conducted at that

school. Investigations on New Jersey No. 60 silica sands, bonded with western bentonite No. 5, have continued, with some modification. Free expansion studies have been completed on 17 mixes, and work on determining hot compressive strength and maximum deformation of these mixes is in progress. Modifications to the dilatometer and load-deformation autographic recorder were described in the report.

Free expansion characteristic curves of sand mixes tested, with additives, were reported as similar to those of the base sands and the actual values obtained show the slight effect of additives in some cases, but not in others. In order to determine scabbing tendencies, it is necessary, the report stated, to know the relation between maximum deformation and maximum expansion over a range of temperatures. Expansion tests alone, therefore, would not permit the drawing of any valid conclusions.

Future work, the committee reported, in order to complete investigation of the effects of additives upon scabbing tendencies of sand mixes, will primarily seek to determine corresponding compressive load-deformation data for the mixes now being studied.

Chairman Sigerfoos presented the progress report on the Mold Surface Committee 8-H: "Metal Penetration Tests on Dry Sand Cores and Core Washes." He outlined a test procedure for investigating penetration, concluding that under the test conditions described, the silica wash used prevented penetration, while the graphite wash tested gave uneven results. Variations in ramming and density, he stated, showed no apparent difference in metal penetration when core washes were used. Unwashed control specimens showed slight decrease in penetration as core density increased. Increasing the Baumé (specific gravity) of the graphite wash, he asserted, did not prevent metal penetration in the corners of the cored cavities.

R. H. Olmsted, Whitehead Brothers Co., Conneaut, Ohio, presided at the Sand Shop Course Monday evening and Robert Frederickson, Saginaw Malleable Iron Plant, Central Foundry Div., GMC, Saginaw, Mich., acted as vice-chairman. Moderator was C. A. Sanders, American Colloid Co., Chicago, and panel members were: D. L. LaVelle, American Smelting & Refining Co., South Plainfield, N. J.; W. M. Ball, Jr., R. Lavin & Sons, Chicago, and Eric Welander, John Deere Malleable Works, East Moline, Ill. Subject of the meeting was "Fundamentals of Sand Control."

Typical questions asked were: Can other metals besides copper-base alloys be cast in synthetic sand mixtures; and Is metal shot, which has been caused from splashing during pouring, detrimental to good molding practice? If so, why?

F. S. Brewster, Harry W. Dietert Co., Detroit, presided at the Sand Shop Course Tuesday evening and C. A. Sanders, American Colloid Co., Chicago, again acted as moderator. "Fundamentals of Sand Control" was again the subject,

and panel members were: W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa; L. E. Wile, Lynchburg, Va., and J. W. Clarke, General Electric Co., Erie, Pa.

Questions asked were: the difference between a shrink and a blow; do tight flasks and bottom boards contribute to gas difficulties in the mold; and how would you spend \$25,000 on one particular operation in a plant.

Last Sand Shop Course was held on Thursday evening, May 13 at the Hotel Statler, with O. J. Myers, Archer-Daniels-Midland Co., Minneapolis, presiding. He was assisted by Vice-Chairman H. W. Schutzenhofer, Key Co., East St. Louis, Ill. Moderator was C. A. Sanders, American Colloid Co., Chicago, who worked with a panel consisting of C. H. Wyman, Burnside Steel Foundry Co., Chicago; and E. C. Troy, consultant, Palmyra, N. J.

Topic for the meeting was "Fundamentals of Sand Control." Discussion centered on the use of silica flour in molds and it was said that the principal purpose is to control metal penetration. A question was raised as to the maximum amount of silica flour for most operations, with reference to 50 per cent as a possibility. Experience was reported with 35,000-lb castings produced in California, using 12 per cent silica flour in the mix.

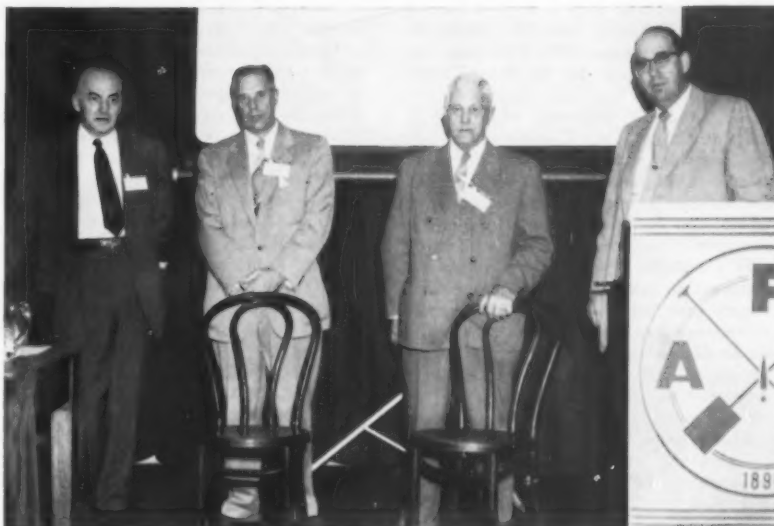
Prefer Longer Mulling Cycles

Panelist E. C. Troy expressed a lack of confidence in silica flour. He offered the opinion that steel foundries prefer longer mulling cycles with less bentonite. Such procedure results in lower hot strength and reduced flowability.

It was suggested that silica flour is added to facing sands to maintain permeability range, give higher hot strength, and increase the density, in addition to penetration control.

At the Sand Round Table Luncheon, the Sand Division tried something new with each committee chairman reporting briefly on his group's activities and what was coming up in the future. Frank S. Brewster, Harry W. Dietert Co., Detroit, in opening the session, referred to sand control as "methodical management of molding materials." Elmer C. Zirzow, Werner G. Smith Co., Cleveland, presided throughout the meeting. O. J. Myers, Foundry Products Div., Archer-Daniels-Midland Co., Minneapolis, reviewed Sand Division history, recalling the part played by the late Dr. H. Ries and other pioneers in foundry sand technology in developing and coordinating AFS sand activities. Myers, as chairman of the Sand Program & Papers Committee, invited listeners to submit papers for the 1955 AFS Convention early.

R. H. Olmsted, Whitehead Bros. Co., Conneaut, Ohio, described the work of the Sand Shop Course Committee in staging informal sessions directed primarily at helping the operating man. M. H. Horton, Deere & Co., Moline, Ill., stated that a study of mulling techniques undertaken by a committee headed by Karl J. Jacobson, Griffin Wheel Co., Chicago, was progressing but



At the Plant and Plant Equipment Session Wednesday afternoon from left to right: W. R. Jaeschke, Whiting Corp.; H. W. Johnson, Wells Manufacturing Co.; James Thomson, Continental Foundry and Machine Co., and D. E. Gilchrist, Deere and Co.

the work was not ready for reporting. G. J. Grott, Unicast Corp., Toledo, Ohio, said that a glossary prepared by the Nomenclature Committee had been completed and was undergoing review by the division's Executive Committee. H. W. Meyer, General Steel Castings Co., Granite City, Ill., commented on the work of the committee on High Temperature Properties of Steel Sand which supervises the AFS-sponsored research at Cornell University.

In the absence of Committee Chairman Robert L. Doelman, Miller & Co., Chicago, Mr. Zirzow stated that the Committee on High Temperature Properties of Iron Sand is the only committee in the division with a waiting list. A real working committee, the group meets several times a year to personally make castings and perform laboratory tests in an effort to correlate test results with production problems and casting defects relating to sand.

Brings Greetings

Harry W. Dietert, Harry W. Dietert Co., Detroit, brought the group the greetings of the national officers and directors of AFS and indicated that the Board was developing increased interest in foundry sand problems. Hans J. Heine, AFS technical director, commented on the work of the Shell Mold Committee in developing a standard sand and shell test methods, in the absence of G. A. Conger, Cambria Foundry & Engineering Div., Stevens Mfg. Co., Ebensburg, Pa., chairman of the committee. The Green Sand Properties Committee is surveying sand laboratories in a further effort to refine test procedures and promote greater standardization according to Bradley H. Booth, Carpenter Bros., Inc., Milwaukee.

Studies of the Mold Surface Committee, currently directed toward investigation of reactions at the mold-

metal interface and the role of mold washes in them, are carried on by the Canadian Department of Mines & Technical Surveys (steel), at Ohio State University (non-ferrous), and at Michigan State College (gray iron), according to Prof. C. C. Sigerfoos, Michigan State College. Clyde A. Sanders, American Colloid Co., Chicago, briefed the group on work of the Sand Handbook Committee and the Grading & Fineness Committee. Current thinking of the Handbook Committee favors a text on foundry sands interpreting test results and covering operating practices and data, he said.

Interested in Carbonaceous Materials

W. R. Moggridge, Ford Motor Co. of Canada, Ltd., Windsor, Ont., said that the Carbonaceous Mold Materials Committee was interested in all carbonaceous materials, both mineral and organic, and was currently studying the effects of composition and grain size on the effectiveness of such materials. The Flowability Committee is attempting to develop tests to measure mass movement in the flow of molding sand and flow required to give smooth mold surfaces, according to C. E. Wenninger, National Engineering Co., Chicago. Mr. Zirzow wound up the series of reports with a discussion of Core Test Committee activities which are now concerned with stickiness, gas content, bakability, and blowability.

MALLEABLE IRON

PROGRAM for the Malleable Iron Division was concentrated into three technical sessions, two shop courses, and a round table luncheon. They were all scheduled on Monday and Tuesday of Convention week.

The Malleable program opened on

Monday morning with a session headed by R. V. Osborne, Lakeside Malleable Castings Co., Racine, Wis. Vice-chairman and secretary was H. C. Stone, Belle City Malleable Iron Co., Racine.

W. K. Bock, National Malleable & Steel Castings Co., Cleveland, opened the meeting with a paper, "Effect of Plastic Deformation of Hard Iron on Subsequent Annealing." Prequenching of white iron has been found to increase the graphitization rate, Bock said, probably producing stresses which aid in the process. He postulated his paper on the theory that "anything which would raise the energy level of . . . white iron would be an aid in graphitization." Plastic deformation in cold work will result in retention of a certain part of the energy by the metal, after the forces doing the cold work are removed. A Brinell impression was used, the simplest method of working white iron for experimental purposes.

Bock concluded that graphitization rate can be increased by raising the energy of the white iron system before anneal. Plastic deformation, he continued, can increase graphitization effectively as a function of the depth of the impression. The amount of plastic deformation required to produce increased graphitization is limited, he acknowledged.

Floyd Brown, North Carolina State College, Raleigh, concluded the meeting with a paper: "Effect of Prebaking in Malleablizing Iron." In prebaking, he said, white cast iron is held isothermally at some subcritical temperature, or is heated slowly through the subcritical range, developing many more graphite nodules during subsequent first stage malleablizing. Optimum temperature for this prebaking for maximum increase in nucleation, he stated, lies between 350-450 C. Brown placed it at 400 C.

Hydrogen removal has been rationalized as one of the involvements in the prebaking phenomenon, but, Brown declared, the effect does not necessarily involve hydrogen. He maintained that the process occurring during prebaking is the true formation of a graphite nucleus, not some other reaction which later supplies a favorable site for graphite nucleation. This postulation is supported by the fact that hydrogen inhibits the prebaking effect.

Two Malleable sessions were scheduled Monday afternoon. The first was presided over by W. A. Kennedy, Grinnell Co., Inc., Providence, R. I. G. B. Mannweiler, Eastern Malleable Iron Co., Naugatuck, Conn., acted as both vice-chairman and secretary.

R. W. Heine and G. E. Kempka, University of Wisconsin, Madison, presented a progress report on AFS research: "Some Effects of Melting Furnace Atmospheres on Tensile Properties and Annealability of Malleable Iron." Melting furnace atmospheres, they reported, have been found to cause pronounced changes in tensile properties of malleable irons. They also reviewed tests on fluidity, hot tearing, and mottling tendency of the iron. Gas analyses were used to provide data on the composition

of gases entering and leaving the melting furnace chamber.

Metal analyses obtained in heats melted under various atmospheres, they stated, were positively related to the atmosphere type employed. Although silicon oxidation losses occur during melting down only, they are incidental unless free oxygen or water vapor is present in the furnace atmosphere. Gases high in CO₂ do not cause silicon losses during melting down, they stipulated.

The authors, studying data from tensile test bar castings, determined that mechanical properties of malleablized iron are markedly influenced by furnace atmosphere. Nitrogen, they said, has a pronounced effect in raising yield and tensile strength of both duplex and cold melt malleables. A nitrogen-rich atmosphere, free of oxygen and water vapor, is most effective in raising yield and tensile strengths when applied during melting down and holding, rather than during holding period only. Free oxygen, they continued, impairs tensile properties of duplex and cold melt irons whenever present. Silicon percentage alone, at constant carbon content, does not exclusively control tensile properties of malleable iron, they declared.

Increased carbon content lowered tensile properties, especially ductility, regardless of melting furnace atmosphere. Studying atmosphere effect on graphitizing behavior in the malleablizing heat treating cycle, they reported that the shortest first stage graphitization (FSG) is obtained when metal is held under a reducing atmosphere. Nitrogen-rich atmospheres tend to retard FSG. However, water vapor seemed to have no effect of retarding FSG. Exothermic oxidation of the iron extends the FSG time.

Concerning second stage graphitization (SSG), they discovered that a 100 per cent carbon monoxide melting atmosphere permits the most rapid occurrence, while nitrogen develops resistance to SSG, particularly when present during the melting down stage of the heat. Maximum annealing resistance is found when exothermic oxidation during melting results in low silicon percentage in the iron.

It now appears, concluded Messrs. Heine and Kempka, that certain gases in combustion atmospheres largely control the effects of the melting furnace atmosphere: nitrogen, water vapor, oxygen.

Prof. Heine collaborated with J. P. Frenck, University of Wisconsin, on the second paper: "Strength of White Irons in the Temperature Range of Hot Tearing." They presented data on the tensile strength of white irons at temperatures where hot tearing is most likely to occur. White iron, they said, has substantial tensile strength in the liquidus-solidus temperature range and it increases with decreasing temperature. Irons of several compositions were tested to determine rupture temperatures under applied stress of 50-60 psi.

Frenck and Heine classified factors influencing hot tearing as: (1) inherent characteristics of the metal, and (2)

external factors. Hot tears occur only when stresses are produced in the metal exceeding its strength and ability to deform in the hot tearing temperature range. Contraction rate is the other principal factor involved in hot tearing, they concluded.

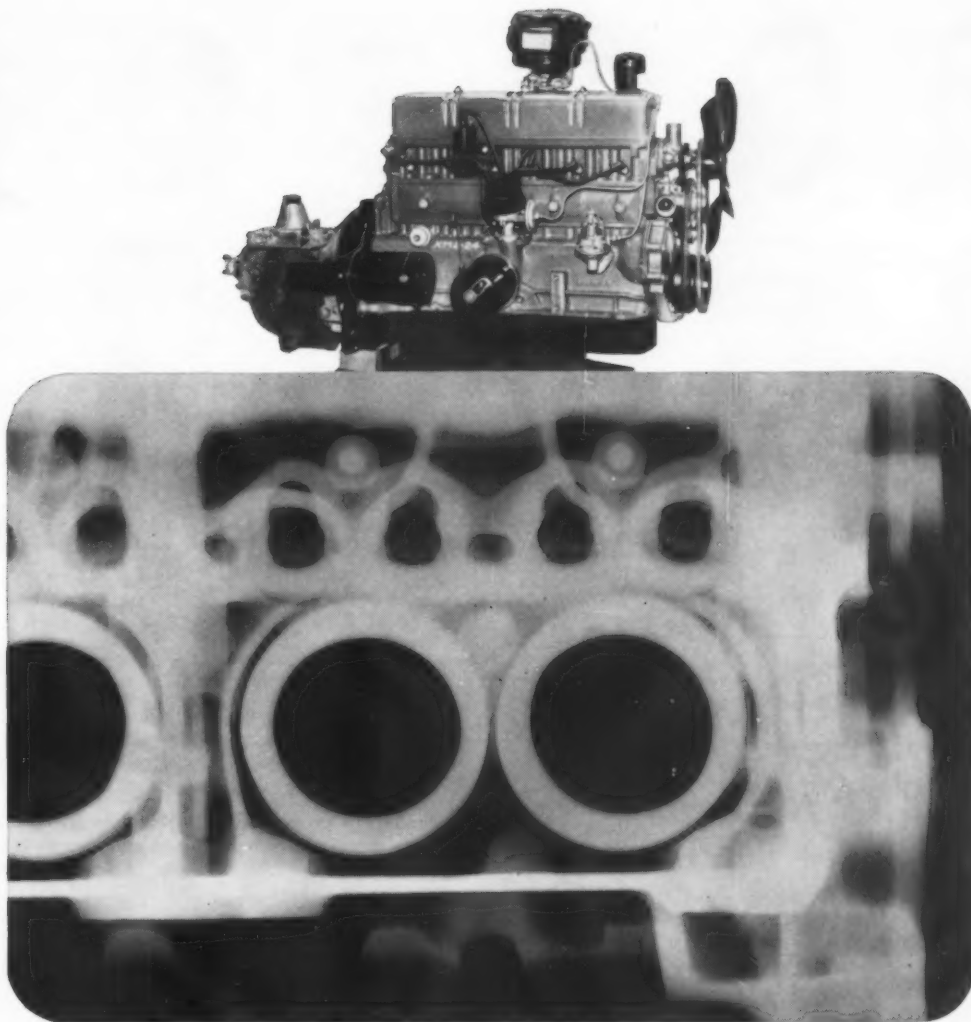
The Tuesday morning Malleable session opened with a paper by H. A. Schwartz and J. D. Hedberg, National Malleable & Steel Castings Co., Cleveland: "The Graphitization of Rims in Malleable Iron." W. D. McMillan, International Harvester Co., Chicago, presided; R. Schneidewind, University of Michigan, Ann Arbor, was vice-chairman and secretary.

Schwartz and Hedberg explored the mechanism and the time-graphite relation in a rim surface layer as compared with the interior, white iron structure. They investigated the fundamentals of the graphitizing process in rims. Most of their attention was focused on the intermediate stage between the A₁ stable and metastable points. Some areas, they said, represent gamma iron solutions in equilibrium with cementite, others such solutions in equilibrium with graphite. Metallographic evidence showed that the outer layer seemed to graphitize by two mechanisms—a very slow process next the skin, and a somewhat faster but similar one in the next few layers inward.

J. E. Rehder Canada Iron Foundries, Ltd., Montreal, Canada, with his subject, "The Effect of Atmospheres on the Rate of Anneal of Black Heart Malleable Iron," offered a critical review of the available literature on the topic. The fastest anneal, he said, is obtained in a pure vacuum, which is hardly practicable in commercial operations. A pure nitrogen atmosphere will increase anneal time 50 per cent over the vacuum, according to past research. Oxygen, Rehder reported, has virtually no effect on anneal rate, but hydrogen will strongly inhibit graphitization. Even ten per cent hydrogen in the atmosphere can produce pearlitic rims, and make the iron unsatisfactory. Several investigators have indicated that air in itself has no significant effect on graphitization. Carbon monoxide and the dioxide are considered together and will show some control over annealing at pressurized atmospheres.

Commercial control of annealing atmospheres is first tried about 1929, Rehder indicated, when experiments showed that decrease of oxygen content produced a reduction of decarburization. Salt baths were patented in the early 1930s and were used by the Germans to anneal pearlitic bomb cases during World War II. The CO-CO₂ ratio receives the most attention in commercial practice, but varies from 1.9 to 8.0. Addition of nitrogen seems to produce the most practicable atmospheres for commercial work although the range is broad, with apparently satisfactory results over a broad spread.

The Monday afternoon Malleable Shop Course was devoted to melting
continued on page 92



Production line "bugs" get X-RAYED out on the pilot model

MASS production of car engines calls for a continuous run of castings as uniformly sound as it's possible to pour. No sand holes. No gas holes. No core shifts.

Manufacturers take care of that early in their plans. They radiograph

pilot castings—can spot thin walls, "out-of-rounds," and other irregularities which a change in casting procedure can forestall.

Improving yield is one of the reasons more and more foundries are making radiography routine. It is

the one way to be sure only high-quality work is released.

Radiography can improve your plant operation. How? Your x-ray dealer will tell you. Or, we'll send you a free copy of "Radiography as a Foundry Tool."

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Convention

WHAT'S YOUR CONVENTION PERSONALITY I. Q. ?????

These caricatures of foundry industry personalities were drawn by Lenn Redman in the AMERICAN FOUNDRYMAN booth at the recent AFS Convention and Exhibit. How many can you identify? Check against the list on page 86.

Readers who send AMERICAN FOUNDRYMAN certification of complete, accurate identification may receive a special sample of a Latin-American, low-friction sand additive tentatively designated 12BaNa₂S.



James H. Smith, General Motors Corp., poses for artist Redman.





Caricatures



Foundry Tradenews

Dike-O-Seal, Inc., has been organized in Chicago to produce and sell a line of rubber, plastic, and low-melting alloy core box seals. Officers are: president, Richard L. Olson (also a partner in Engelwood Pattern and Model Works); vice-president, William Halvorsen; assistant vice-president, Paul A. Olson; secretary, Arnold E. Larsen; and treasurer, Florence L. Olson.

Howard Foundry Co., Chicago, is opening a new lost-wax precision investment casting division in Los Angeles, which will be staffed by personnel from the company's Milwaukee plant. The new production facility will house a new type titanium casting furnace for the first commercial operation of its kind by the company's new subsidiary, Titanium Casting Corp.

Charles Taylor Sons Co., a subsidiary of National Lead Co., manufacturers of special refractories, announces the appointment of **Ferro Corp., International Div.**, Cleveland, as their exclusive export representative for Central and South America, Japan, and the Union of South Africa. Chas. Taylor will continue to be represented in Canada by Refractories Engineering & Supplies, Ltd., Hamilton and Montreal; and in Mexico by Amerex Ingenieros, S. A., Mexico City.

The Day Co., Minneapolis, manufacturers of dust control and bulk material storing and handling equipment, is expanding production facilities with the purchase of the factory building at 1153 Sixteenth Ave., S.E., Minneapolis. Day Co. operates six plants in the U.S. and Canada.

Buehler Ltd. is now occupying a new, 34,000 sq ft plant in Evanston, Ill., where all manufacturing, office, and display facilities are concentrated. Buehler makes a wide line of metallographic testing equipment.

Rotor Tool Co., Cleveland, has appointed the **Big Three Welding Eqpt. Co.**, with 21 offices in three states, to distribute their pneumatic and high-cycle electric tools in Texas, Oklahoma, and New Mexico.

Since March 1, **Penola Oil Co.** has had its Detroit sales office in new and larger quarters at 14300 McNichols Road, West.

American Brake Shoe Co. has opened a new sales and technical service office in Duluth, Minn. The company will now be in a better position to offer its manufacturing facilities and technical services to the Iron Range mining companies of the area on problems of equipment and materials wear. John V. Houston, Jr., of Brake Shoe's New York headquarters division, has been named to head the new office. Houston was formerly with the company's Brake Shoe & Casting Div.

Lebanon Steel Foundry, Lebanon, Pa., has published a new, 32-page brochure, lithographed in two colors, that treats the entire process of steel casting manufacture from the design and engineering phase to final applications of the product. Modern steel castings are traced from initial design and patternmaking, through molding and coremaking, the applied science of metallurgy, tapping of furnaces in the carbon and low alloy foundry and stainless steel foundry, pouring, finishing operations, heat-treating, testing, and inspecting. Copies of the brochure are available on request on your company letterhead, addressed to W. H. Worrielow, Jr., general sales manager, Lebanon Steel Foundry, 54 Lehman St., Lebanon, Pa.

Stanley G. Flagg & Co., Inc., Philadelphia, and Stowe, Pa., commemorating its 100 years in business, has published a case-bound book detailing the history of the company from 1854 to 1954. Book illustrates early calling cards and advertisements the firm used as well as copies of the first ledger listing some purchase and expense items characteristic of the day, and some accounting methods in common use in business in 1854. It tells how some of the old pipe fitting problems were solved by the founder, Stanley G. Flagg. Also included, are illustrations and descriptions of the company's present facilities and products. Officers and key members of the firm are included in the book.

American Brake Shoe Co. has signed an agreement to purchase the assets of the **Metallic Friction Materials Co.** of Cleveland. The plant will be operated with present personnel as part of the Sintermet Div.

SPO, Inc., will add 7200 sq ft of factory production area to its present manufacturing facilities in Cleveland. New addition involves an expenditure of more than \$150,000 and has been necessitated by the increased demand for the Spomatic fully automatic molding unit as well as other SPO foundry equipment, it is pointed out.

U. S. Reduction Co., East Chicago, Ind., and Toledo, Ohio, is celebrating its 50th year in business. In 1910 USCO had outgrown its cramped space in Chicago and moved to east Chicago, Ind. By 1949, the need for additional facilities was evident and the company opened a plant in Toledo, Ohio. The firm produces all types of aluminum alloys for aluminum foundries. These include alloys for die-casting, sand, permanent mold, shell mold and plaster. Firm also produces a complete line of zinc base alloys. To commemorate the occasion the company has published a booklet outlining the history of the firm and describing some of its various products.

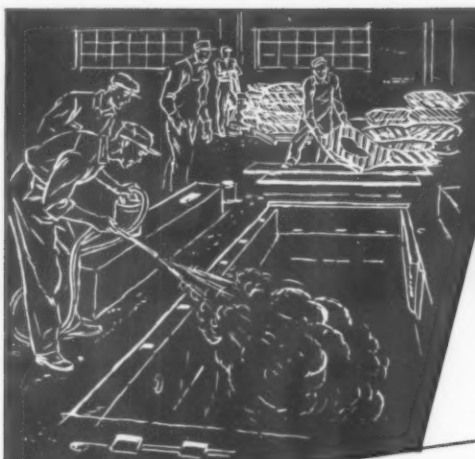
Equipment Given to University of Wisconsin

A foundry shake-out machine, especially designed, was presented to the department of Mining and Metallurgy of the University of Wisconsin by Hewitt-Robins, Inc. The formal presentation was made by H. A. Schuler, manager of conveyor sales, Chicago district, at a special meeting of the university's AFS student chapter, held in the Cast Metals Laboratory.

Mr. Schuler also talked to the student members on "Materials Handling in the Foundry Industry." James Ewens, vice-president, Grede Foundries, Inc., Milwaukee, and chairman of the Wisconsin-F.E.F. Industry Advisory Committee, presented scholarship certificates to 13 scholarship holders in the University.



Lebanon Steel Foundry's new, 32-page, two-color brochure is handsomely illustrated with photographs of foundry operations, with considerable attention to centrifugal casting.



HEAVY MACHINE TOOL CASTINGS.
PROBLEM: Casting surfaces showed chipping marks. Metal penetration was very bad, and an entire day was needed to clean the castings.
SOLUTION: STEVENS Mold Coating. #380 Core and

RESULTS: Castings for which #380 was used did not show a single chipping mark, saving of six man hours of cleaning room time.

COUNTERWEIGHTS WEIGHING SEVERAL TONS.
PROBLEM: Sand sticking after shake-out.
SOLUTION: STEVENS #180-D Core Coating mixed to 45° Baumé.

RESULTS: All cored casting surfaces are smooth and 98-100% of core sand falls off at shake-out.

AUTOMOTIVE CYLINDER BLOCKS.
PROBLEM: Core coating spalling off in large sheets due to thermal shock in the oven. The exposed area caused metal penetration, increasing cleaning room costs.

SOLUTION: STEVENS Seal-Cote Core Coating.
RESULTS: Coating easily applied, good suspension at low Baumé. Core coverage was excellent. Using same core sand mix, coatings did not blister or spall off with increased oven temperature.

MORE SAVINGS STORIES PROOF THAT **STEVENS** CORE COATINGS...

ARE YOUR SHORT-CUT TO BETTER CASTING RESULTS

The above reports are typical of the results experienced by many foundries which are Stevens customers. Yes, when you have a facing problem your Stevens representative and Stevens technical and laboratory facilities are at your command. You can call for a technician to come in and analyze your present coating operation and work with you to find a faster, more efficient and economical way to coat your cores and molds.

And, in addition, when dealing with Stevens, you'll always be assured of controlled-quality facing products . . . just as outstandingly superior

in the field as the Stevens reputation for service and integrity. Call in your Stevens representative now . . . or write today for Stevens Technical Bulletins F-106 and F-108 covering preparation and correct use of core and mold coatings in your foundry. **FREDERIC B. STEVENS, INC.**, Detroit 16, Michigan.

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
ELECTROMET ferrovanadium is uniform in analysis, closely graded, correctly sized, and physically clean. There are four grades — high-speed, special, open-hearth, and foundry.

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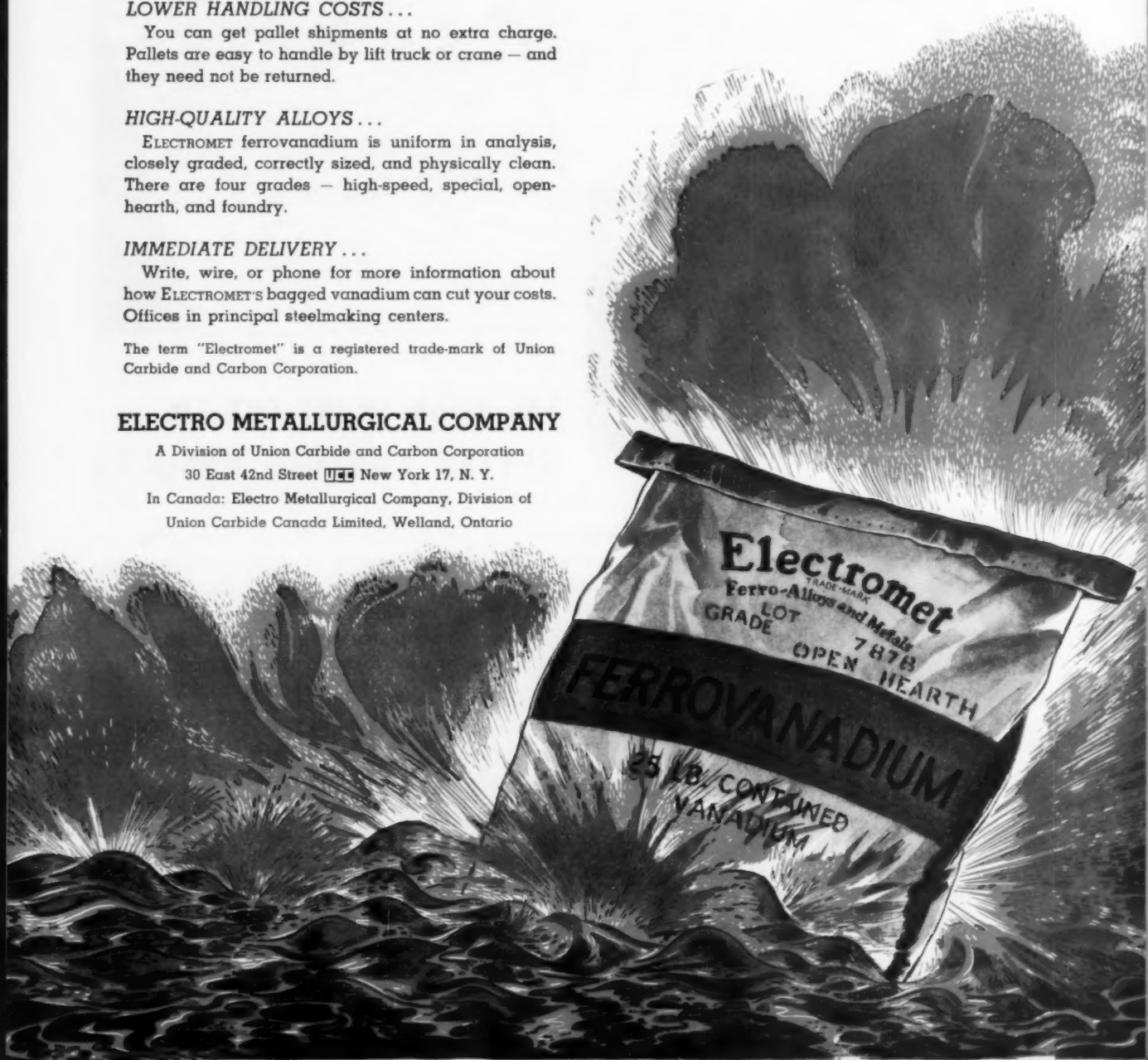
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Foundry Facts

Evaluation of Casting Processes

Condensed from the article in the March issue of *Product Engineering* by P. W. Boomer and S. C. Tingquist, Westinghouse Electric Corp., East Pittsburgh, Pa.

Of all the methods of forming, casting is probably the most versatile. However, there is no definite procedure that can be used for evaluating a particular design to decide whether or not the part should be cast, and if so, in selecting the best casting process. Consideration of various criteria will simplify the selection of the best process. The six basic casting methods—sand, shell, plaster, investment, permanent mold, and die—have been compared in the table (see page 84 also) on the basis of ten criteria.

After considering the various factors, applicable methods generally narrow down to two or three. Final choice will be dictated by the most economical method of producing the parts in the desired quantities.

In general, the following formula may be used:

$$\text{Unit Cost} = \frac{T + N(P + M + F + A)}{N}$$

Where T is the total tool cost, P the price per piece quoted by the manufacturer, M the customer's cost of machining the piece, F the customer's cost of finishing the piece, A the customer's cost of fitting the part into a composite assembly, and N the number of parts making up the whole lot. The purchaser should not be prejudiced against a certain process if one of these factors seems to be much higher than it is for another process as long as some of the other factors make up for it.

Process	Sand Casting	Shell Molding	Plaster Casting
Cost	Hand methods—High labor and equipment cost, low tooling cost. Mechanization—Low labor cost, high tool and equipment cost. Production quantity determines method to be used. Extensive machining if part is unusable in as cast condition.	Low labor cost, medium tool and equipment cost. Process lends itself to a high degree of mechanization. Little machining necessary unless very close tolerances and finish are desired.	High labor cost, medium tooling and equipment cost. Part cost fairly high. Limited mechanization is possible. Little machining except if very close tolerances are desired.
Size and Weight	Wide range from a few oz to 100 tons or greater. Wide use in medium and heavy range. Material used is usually determining factor.	Application in range of $\frac{1}{2}$ to 20 lb. Special casting to 200 lb.	Standard size about $12 \times 18 \times 4$ in. Weight up to 15 lb. Special parts to 35 in. dia. and 200 lb.
Complexity	Simple to very complex shapes that require extensive coring. Particularly re-entrant angles or internal coring.	Simple to limited coring. Must have slight draft.	Permits the production of intricate design features to an accuracy that requires little or no machining.
Section	$3/16$ in. for small parts. Generally $\frac{1}{4}$ in. for small and medium parts. For highly stressed or pressure tight parts, $\frac{1}{2}$ in.; for large parts $\frac{3}{4}$ in. Sections 4 ft. thick have been cast in steel.	Relatively thin sections $\frac{1}{8}$ in., or less are standard.	Thin sections possible to 0.040 in. if area is smaller than 2 sq. in. 0.062 in. for 4 to 6 sq. in. 0.093 for areas to 30 sq. in.
Surface Quality	Inferior to die or permanent mold castings. Surface roughness range 250 to 1000 rms. Special facing sands can reduce value below 250.	Superior to sand castings on ferrous castings. Excellent on non-ferrous.	Production roughness to 30 rms or better.
Mechanical Properties	Generally lower than other processes. Can be improved by metallurgical control.	Better than sand casting. Improvement attributed to metallurgical control.	Tensile properties low because of slow cooling and solidification.
Production	Low to High Production—Depending upon application.	Medium to high process. 1000 to 100,000 units.	Low. Not a high production process. 150 to 450 pieces per pattern per week.
Dimensional Tolerances	Small to medium castings, $\frac{1}{8}$ in. min. stock for finished surfaces. Large units, $\frac{1}{4}$ in. Generally depends on metal being cast.	Very good tolerance ± 0.005 in./in. (Not applicable in parting plane.) ± 0.010 across part plane.	± 0.005 in./in. for production casting. ± 0.010 in./in. across parting line.
Applications	Gears, framing members, housings, motor blocks and structural members when cast structures having relatively low strength and resistance to impact are satisfactory. Usually limited to cast iron and cast steel for industrial equipment.	Valves, crankshafts, parts made by rough machining and forging. Possible applications in heat resistant and special alloys such as titanium alloys.	Torque converters, complicated copper-base parts, machine parts. Can cast around inserts.
Materials	Steel, cast iron, copper-base alloys, aluminum alloys, and magnesium alloys.	Best for high alloy steels, cast iron, copper and aluminum alloys. Carbon steel, magnesium and special alloys can be cast.	Any non-ferrous alloy with a melting point of less than 2000 F except magnesium in large sizes. Includes aluminum, brass, bronze, beryllium, copper.

Process	Permanent Mold	Die Casting	Precision Investment Castings
Cost	High labor, tooling and equipment costs. Fairly high part cost. Little machining necessary except for very close tolerances.	Low labor cost, high tooling and equipment costs. Low part cost on high quantity items. Machining usually not necessary.	High labor cost, low tooling and equipment costs. High part cost. Little machining necessary.
Size and Weight	A few oz to 500 lb. Usually medium and large parts. Used between sand and die casting.	No real size limitation. Size depends upon casting equipment available. Present maximum weights are: 15 lb aluminum, 10 lb magnesium and 30 lb zinc.	Size range up to 16 in. Weight range to 35 lb. Most parts from 1 oz to 3 lb.
Complexity	Simple parts with limited coring.	From simple to very complex.	Intricate shapes not readily made by machining, forging or sand casting can be produced.
Section	Sections to 1½ in. Gray iron min. section about 3/16 in.	0.040 in. to a max. of 1½ in. if some voids are permissible. Usually ½ in. maximum.	Tolerance in walls no less than 0.005 in. min. Max. section about 1.0 in.
Surface Quality	Surface dependent upon the condition of the mold. Can be machined or ground but usually left with base metal surface.	Excellent, 40 to 100 rms. Can be finished with a variety of mechanical, plated, chemical or organic finishes.	50 to 80 rms normal finish.
Mechanical Properties	Strength about 10 to 20 per cent over sand castings.	High surface strength, poor if machined.	About equal to mean between transverse and longitudinal values for rolled bars of the same metal and alloy.
Production	Relatively low. Lies between sand and die casting.	Very high. Up to 500 shots/hr possible with some parts.	In normal alloys low to medium. In special alloys low to high.
Dimensional Tolerances	Fixed cavity tolerances run ± 0.020 in. and ± 0.030 in. across parting line. Solid die tolerances run ± 0.010 in. for 1 in.	0.0015 in./in. for magnesium and aluminum. 0.001 in./in. for zinc. 0.003 in./in. for copper base. Above for any one dimension. Dimensions across die parting line are normally about double above figures.	Min. general tolerances are ± 0.005 in./in. ± 0.003 for each additional inch for ferrous. Lowest production cost where tolerance is set at ± 0.010 in./in.
Applications	For parts similar to sand castings but which may have superior surface finish, closer tolerances and better strength in as cast condition.	Structural parts, machining elements, and decorative members and parts for automotive, business machine, electrical appliances, and all other high production industries.	Small intricate shapes made in limited quantities, usually from high alloy metals.
Materials	Best for zinc, aluminum, copper-base alloys. Cast iron for some applications. Not suitable for steel.	Lead, tin, zinc, magnesium, aluminum and copper alloys.	Iron, zinc, magnesium, aluminum, copper-base alloys, and especially high alloy steels.

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and Dewatering Tanks • "Wear-Proof"
Centrifugal Slurry Pumps

Caricature Quiz Answers

Here are the correct identifications for the AMERICAN FOUNDRYMAN caricature quiz on pages 78-79:

1. J. D. Mannigan, Genesee Foundry Co.
2. D. E. Mathieu, Alabama Pipe Co.
3. Sig Johnson, Woodruff & Edwards, Inc.
4. Barney Bernbaum, Standard Brass Foundry Co.
5. M. T. Ganzauge, General Railway Signal Co.
6. A. A. Diebold, Atlas Steel Casting Co.

7. Walton L. Woody, National Malleable & Steel Castings Co.
8. D. E. Best, Bethlehem Steel Co.
9. Frank J. Dost, Sterling Foundry Co.
10. N. S. Covacevich, Mexico City, Mexico
11. Al Gallo, Hampden Brass & Aluminum Co.
12. Monroe Brown, Locomotive Finished Material Co.
13. J. S. Csaklos, Crucible Steel Castings Co.
14. Frank Riecks, Ford Motor Co.
15. Robert Ronceray, Bonvillian & Ronceray, Choisy, France
16. E. E. Pollard, Alabama Pipe Co.
17. W. B. Bishop, Archer-Daniels-Midland Co.

18. L. H. McReynolds, Jeffrey Mfg. Co.
19. Frank Watt, Frederic B. Stevens, Inc.
20. R. K. Quigley, Clearfield Machine Co.
21. Doug Albert, VacuBlast Co., Inc.
22. J. F. Pace, United Oil Co.
23. A. L. Gardner, Pangborn Corp.
24. Claude B. Schneible, Claude B. Schneible Co.
25. Bruce L. Simpson, National Engineering Co.
26. Larry D. Pridmore, International Molding Machine Co.
27. Lester B. Knight, Lester B. Knight & Associates
28. W. B. Wallis, Pittsburgh Lectromelt Furnace Co.
29. E. F. Peterson, Martin Engineering Co.
30. L. S. List, U. S. Hoffman Machinery Corp.
31. C. O. Bartlett, C. O. Bartlett & Snow
32. James H. Smith, Central Foundry Div., General Motors Corp.
33. Harry W. Dietert, Harry W. Dietert Co.
34. T. W. Pangborn, Pangborn Corp.
35. J. G. Winget, Reda Pump Co.
36. Collins L. Carter, Albion Malleable Iron Co.
37. Tom Kaveny, Jr., Herman Pneumatic Machine Co.
38. H. R. Hansen, Clark Eqpt. Co.
39. Judd Holt, Monsanto Chemical Co.
40. William Schwartz, Semet Solvay Div., Allied Chemical & Dye Corp.
41. A. L. Yeager, Gerwin Industries, Inc.
42. George Sheppard, DoALL Co.
43. Dr. C. R. Austin, Meehanite Metal Corp.
44. Aubrey J. Grindle, Grindle Corp.
45. J. R. Russo, Russo Foundry Eqpt. Co.
46. K. A. Miericke, Baroid Sales Div., National Lead Co.
47. S. W. Bodman, Magie Bros., Inc.
48. D. J. Manning, Swan Finch Oil Corp.
49. F. T. Chesnut, Ajax Electrothermic Co.
50. R. K. Strong, Hydro Blast Corp.
51. S. B. Davies, Royer Foundry & Machine Co.
52. Paul Snyder, Rock Island Millwork Co.
53. A. J. Van Harn, Grindle Corp.
54. R. H. Sutter, Sutter Products Co.
55. B. R. Hopkins, Thermex Div., Girder Corp.
56. S. G. Seaton, American Silica-Sand Co.
57. Ronnie Bamber, British Moulding Machine Co., Ltd.
58. R. D. Darrah, Dravo Corp.
59. F. K. Gladwin, Gladwin Corp.
60. H. G. Schlichter, Beardsley & Piper Div., Pettibone-Mulliken Corp.
61. R. G. Mensch, Acme Resin Co.
62. L. W. Follett, Davenport Machine & Foundry Co.
63. G. B. Michie, Electro Refractories & Abrasive Corp.
64. C. H. Barnett, Foundry Eqpt. Co.
65. Al Lenhart, American Wheelabrator & Eqpt. Corp.
66. R. A. Reed, Norton Co.
67. C. V. Nass, Beardsley & Piper Div., Pettibone-Mulliken Corp.

CASTING through the Ages

when casting FIREBACKS,
STOVE TILES AND INTERIOR WALL ORNAMENTS, GERMAN FOUNDRERS OF THE 18th CENTURY OFTEN IMPRESSED IN THE OPEN SAND MOLDS, PRINTS OF THEIR FINGERNAILS, PIPE BOWLS, KNIVES OR GUILD SIGNS TO IDENTIFY THEIR WORK.



The original COAT OF ARMS
OF THE LONDON GUILD OF FOUNDRERS (ESTABLISHED IN 1365 AD), DEPICTED EWEARS OR PITCHERS, WHICH, TOGETHER WITH CANDLESTICKS, BUCKLES, SPURS, STIRRUPS, STRAPS AND POTS, WERE THE ARTICLES THEY COMMONLY MADE.



During THE REVOLUTIONARY WAR, HESSIAN PRISONERS WERE LEASED AS WORKMEN TO SOME PENNSYLVANIA FURNACES TO KEEP THEM PRODUCING NEEDED IRON SUPPLIES.

Odd Bits
A MAMMOTH 147 HIGH BELL, CAST IN CHINA ABOUT 1420 AD, WAS COVERED BOTH INSIDE AND OUT WITH ENOUGH CHINESE CHARACTERS TO FILL 5 VOLUMES OF CLASSICS! THESE CHARACTERS IT IS SAID, WERE ACTUALLY CAST—NOT CUT!



**Courtesy of Chicago Natural History Museum*

through communication...

More than 4,000 years ago, this receipt* for 5590 large bundles of reeds was inscribed on clay in cuneiform writing. Found in Iraq among the famous Kish ruins, the inscription was dated in 2226 B.C.

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Immediate Past-President of AFS, Collins L. Carter, Albion Malleable Iron Co., seated, center, talking with members of the Michigan State College Student Chapter, seated, Fred Hodgson, left, and Bruce Harding, right; standing, Vernon Carlson, left, and Jacob Goldberg, right, at the April meeting of the Chapter.

Chapter News

Still Expanding

As AMERICAN FOUNDRYMAN's deadline closes, membership in the American Foundrymen's Society stands at 11,623; 377 short of the June 30 goal of 12,000. During the first 11 months of the fiscal year, membership grew from 11,151 to the present figure of 11,623, indicating continually growing interest in the objectives and activities of the Society. This increase in membership is evidence of the enthusiasm of Chapter membership committees for making advantages of Society membership widely available.

During May, five new company members were added to the rolls. They are:

Company Members

A-1 Foundry Co., Chicago; Harold W. Young, partner. (Chicago Chapter)
Alloys & Chemicals Mfg. Co., Inc., Cleveland; N. L. Butkin, president. (Northeastern Ohio Chapter)
Mork Foundries, Inc., Beloit, Wis.; H. C. Mork, treasurer. (No. Illinois & So. Wisconsin Chapter)
F. Perlman & Co., Memphis, Tenn.; Saul Perlman, partner (Mid-South Chapter)
South Gate Aluminum & Magnesium Co., South Gate, Calif.; R. M. Stockton, president. (Southern California Chapter)

St. Louis

Almost 100 members and guests attended the annual business meeting and installation of officers of the St. Louis Chapter on May 20, the last meeting of the Chapter until fall.

"Technique for Tomorrow," a film about the new Ford Motor Co. Cleveland

Foundry, was presented. Following the film, guest speaker John M. Harwood, personnel director, Metal Goods Corp., St. Louis, spoke on the subject, "Effectively Working with People," drawing on his extensive background in personnel work and his teaching experience as the source for his material. He stressed the importance of cultivating the proper attitudes among employees, and the need for imparting to each employee a feeling of personal dignity. Attitudes are so important, he stated, because they affect morale, and morale directly affects production output. One method of creating a healthy employee-management relationship is to maintain close personal contact between the individual worker and his supervisor. Harwood's talk was followed by a question and answer period.

After committee reports covering the past year's activities had been given, and retiring Chapter Chairman, Webb L. Kammerer had extended his thanks to all the Chapter members for their cooperation throughout the year, Chapter officers and directors were elected. Named to hold offices for the coming year were: *chairman*, Fred J. Boeneker, Bronze Alloys Co.; *vice-chairman*, George L. Mitsch, American Car and Foundry Co.; *treasurer*, Russell E. Hard, St. Louis Coke and Foundry Supply Co.; *secretary*, Paul E. Retzlaff, Nordberg Mfg. Co. *Directors*: Webb L. Kammerer, Midvale Mining and Mfg. Co.; Arthur O'Hare, O'Hare's Foundry Co.; Fred C. Hatton, Century Electric Co.; Jack Bodine, Bodine Pattern and Foundry Co.

The first Spring Dinner Dance spon-

sored by the St. Louis Chapter was held at Norwood Hills Country Club on May 1 under the direction of Entertainment Chairman John O'Meara and his committee. Two hundred and twenty-six members and guests attended and enjoyed dinner and dancing to the music of Jack Fields' orchestra. Gardenias were presented to all the ladies. High point of the evening was a drawing for several attendance prizes.—*Jack Bodine.*

Twin City

A round table discussion of several phases of the annual AFS Convention and Exhibit in Cleveland, May 8-14, was featured at the May meeting of the Twin City Chapter held at the Covered Wagon, Minneapolis. Panel members consisted of H. H. Blossjo, Minneapolis Electric Steel Castings Co., Minneapolis; C. Fred Quest, J. F. Quest Foundry Co., Minneapolis; O. Jay Myers, Archer-Daniels-Midland Co., Minneapolis, and Nate Levinsohn, Minneapolis-Moline Co., Minneapolis. The panel was moderated by A. W. Johnson, Northern Malleable Iron Co., St. Paul.

Each of the panel members discussed a particular part of the Exhibit that was of personal interest to him and of general interest to the audience. Each man also discussed general features of the technical sessions that he attended.

J. W. Costello, American Hoist & Derrick Co., St. Paul, announced the winners of the Twin City Chapter's Apprentice Contest. The winners were G. Degler, Jr., patternmaker, American Hoist & Derrick Co., St. Paul, and J. Ward, molder, Brom Machine & Foundry Co., Winona, Minn.

It was announced that the annual Twin City Chapter Golf Outing and Banquet will be held August 2 at the Midland Hills Country Club. J. S. Garske, Progress Pattern & Foundry Co., is in charge of arrangements for the outing.—*R. J. Mulligan.*

Michiana

A day-long plant visitation tour was the highlight of the April 12 meeting of the Michiana Chapter held in Warsaw, Ind. Open house for the attending members was held at Dalton Foundries, Inc., Warsaw Foundry Co., Lakeside Foundry, and Huffer Foundry Co.,



Newly elected Chapter Chairman J. A. Van Haver, Sealed Power Corp., left, presenting honorary plaque to retiring Chapter Chairman F. J. DeHudy, Centrifugal Foundry Co., right, at the May meeting of the Western Michigan Chapter.

beginning at 10 am and continuing throughout the day. An unusually high attendance of 200 foundrymen turned out for the activities. Arrangements for the meeting were made by Dan Leedy, plant superintendent, Dalton Foundries, Inc.

New officers for the coming year were installed. They are: *chairman*, Roy Payne, Sterling Brass Foundry; *vice-chairman*, Jim Strom, Strom Brass Foundry, and *secretary-treasurer*, Vernon Spears, American Wheelabrator & Equipment Corp. An evening dinner climaxed the meeting.—*Dan Leedy*.

Tri-State

"Mechnization in Core Making" was the subject of an address by guest speaker Chester V. Nass, vice-president and general manager, Beardsley & Piper Div., Pettibone-Mulliken Corp., Chicago, at the April meeting of the Tri-State Chapter held in the Blue Room of the Alvin Hotel, Tulsa, Okla. Mr. Nass discussed various types of mechanization and illustrated his talk with the showing of a film. He pointed out that all successful foundries are mechanized to a certain degree, regardless of size or type of work, but that over-mechanization can be disastrous. A mechanization program should be planned over a long period of time, he advised, and should be introduced into a shop gradually. The talk was followed by a lengthy discussion period.—*Edward O'Brien*.

Southern California

"Manufacture of Pig Iron," was the topic of a talk given by guest speaker George B. McMeans, vice-president, Kaiser Steel Corp., Fontana, Calif., before 128 members of the Southern California Chapter at the April meeting held at the Rodger Young Auditorium, Los Angeles. Mr. McMeans accompanied his remarks with a movie and slides illustrating the various steps in this operation, which included Kaiser Steel's coal mining operation in Utah and the iron ore mines at Eagle Mountain, Calif.

John C. Beuse, John C. Beuse Patterns, pattern apprentice training chairman, announced the winners in the Chapter's Patternmaking Contest. First prize was awarded to Robert Johnson, Patterncraft Co.; second prize went to Gerald Palmer, Santa Monica Technical School student, and Charles Hull,



Left to right, H. H. Wilder, Vanadium Corp. of America; P. A. Burchell, Pekin Foundry & Mfg. Co.; F. S. Frost and W. G. Macy, American Foundry & Furnace Co., at the April meeting of the Central Illinois Chapter.



Left to right are R. H. Greenlee, Auto Specialties Mfg. Co.; H. James Strom, Jr., Strom Brass Foundry; Leslie Pugh, Casting Service Corp.; Dan W. Leedy, Dalton Foundries, Inc., and V. C. Bruce, Frederic B. Stevens, Inc., at the April meeting of the Michiana Chapter.

Howard Beard Pattern Shop, received third prize.

New Chapter officers for the coming year were elected. Chosen to hold offices were: *chairman*, Charles R. Gregg, Gregg Iron Foundry, El Monte, Calif.; *vice-chairman*, William Baud, Food Machinery & Chemical Corp., Vernon, Calif.; *secretary*, J. William Mitchell, Utility Steel Foundry, Los Angeles; *treasurer*, Frank Wurga, Airesearch Mfg. Co. Div., Garrett Corp., Los Angeles. *Directors*: James Oliva, Oliva & Tatro, Inc., Los Angeles; Fred Dye, Burndy Engineering Co., Inc., Lynwood, Calif.; Harold Bierley, Production Pattern & Mfg. Co., Los Angeles; Arthur Gutch, Dayton Foundry, Hollydale, Calif.—*Otto H. Rosentreter*.

Northeastern Ohio

More than 200 members and guests attended the National Officers Night meeting of the Northeastern Ohio Chapter on March 11, held at the Tudor Arms Hotel, Cleveland.

Special guests for the evening included AFS National Director and Foundry Educational Foundation President Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; AFS Secretary-Treasurer Wm. W. Maloney, and AFS Technical Director Hans J. Heine.

Dr. MacKenzie spoke briefly and extended a welcome and greetings from AFS, F.E.F. and the Birmingham Chapter. Mr. Maloney reported on the progress of the AFS Headquarters building, and announced that it would be ready for occupancy sometime in August. Mr. Heine previewed briefly the technical program for the AFS Convention and Exhibit and gave an indication of the subject matter of some of the technical papers, panels, round tables, and shop courses.

Speaker at the general session of the meeting was Robert H. Zoller, president, Zoller Casting Co., Bettsville, Ohio, who described his company's experiences and the technique developed for the operation and use of a basic-lined, water cooled cupola which requires the bottom to be dropped only once a week. Prof. Charles F. Walton, Case Institute of Technology, was the general session chairman.

Approximately 40 members of the patternmaking division gathered in separate session to hear M. K. Young, U. S. Gypsum Co., present a paper on "Hydrocal Patternmaking." Mr. Young described the latest types of plaster available, types with characteristics which greatly increase the utility of plaster as a pattern material. They do not set too speedily, expand upon hardening, are very hard when dry, and can be prepared to compensate for shrinkage allowance. They are particularly useful for making large patterns for short-run production for which wood or metal patterns would be too expensive, but they also have applications for patterns for plastic coreboxes, matchplates, stretchplates for stretching aluminum and for other purposes. John Roth, Cleveland Standard Pattern Works, was the chairman of the session.—*Kenneth L. Mountain and Jack C. Miske*.

Birmingham

The April meeting of the Birmingham District Chapter took the form of an excursion to the University of Alabama in Tuscaloosa, Ala. Sinclair Latham, Jr., chairman of the University of Alabama Student Chapter, presided at a luncheon for the approximately 65 visiting foundrymen.

A technical session, held in the University's Physics Building, followed luncheon. Guest speaker was W. D. Stewart, staff metallurgist, Castings Div., Aluminum Company of America, who addressed the group on the subject "Aluminum Sand Foundry Practice."

After the technical session, the guests visited the College of Engineering foundry.—*J. A. Wickett*.

Western Michigan

At the May meeting of the Western Michigan Chapter held at Cottage Inn, Muskegon, Mich., the following officers were elected to direct the Chapter's activities for the coming year: *chairman*, John A. VanHaver, Sealed Power Corp.; *vice-chairman and program chairman*, George W. Bartlett, Lakey Foundry Corp.; *secretary*, John B. Powers, Campbell, Wyant & Cannon Foundry Co.; *treasurer*, Henry A. Laforet, Lakey Foundry Corp.



John H. Harwood, Metal Goods Corp., St. Louis, second from left, speaking at the May meeting of the St. Louis Chapter. Left to right, Jack Bodine, Bodine Pattern and Foundry Co.; speaker, John H. Harwood; retiring Chapter Chairman Webb Kammerer, Midvale Mining & Mfg. Co.; newly elected St. Louis Chapter Chairman Fred Boeneker, Bronze Alloys Co., and Chapter Secretary, Paul Reitzlaff, Nordberg Mfg. Co.

Technical Chairman for the meeting, C. H. Cousineau, Carpenter Bros., Inc., introduced the principal speaker of the meeting, Joseph S. Schumacher, chief engineer, Hill & Griffith Co. Mr. Schumacher spoke on the subject "Foundry Sands."

An honorary plaque was presented to F. J. DeHudy, Centrifugal Foundry Co., who completed his term as chairman and was elected as a Chapter director for the coming year.

It was announced that a donation of \$1000 was given by the Chapter to the D. J. Campbell Memorial Fund to be awarded to qualified foundry students in the form of scholarships.—*Wilson W. Hicks.*

Mid-South

"Safety in the Foundry" was the subject of an address by Edward Boywid, foundry supt., International Harvester Co., Memphis, Tenn., principal speaker at the April meeting of the Mid-South Chapter held at the Hotel Chisca in Memphis, Tenn. Mr. Boywid discussed safety problems and how they can be solved, and stressed the importance of a good, active safety program.

Top management, supervisors, and employees are the three major groups involved in a safety program, he stated. Top management is responsible for outlining the over-all program, and for providing safe working conditions. Supervisors play the most important role in a successful safety program because they have the multiple responsibility of selling safety directly to the employees, instructing them in the safest way to do a job, and protecting the employees under their supervision at all times. Employees must be made to feel that they are a part of the company's safety program. This can be accomplished in some measure through safety literature, posters, movies, and lectures.

Boywid traced the progress the foundry industry has made in the field of safety, and concluded with the following list of basic safety rules: 1. Work carefully and avoid recklessness; 2. Keep your mind on the job and don't day dream; 3. Report even the slightest injury immediately.—*Raymond C. Morin.*

Michigan State College

Several members of the Albion Malleable Iron Co., Albion, Mich., were guest speakers at the April meeting of the Michigan State College Student Chapter. Immediate Past-President of AFS Collins L. Carter, Albion Malleable Iron Co., the first speaker, addressed the group briefly on the objectives and varied activities of AFS and urged the students to support and participate in the Society's programs following their entrance into industry.

Discusses Sales Department

After Mr. Carter's talk, Richard Dobbins, a sales representative of Albion Malleable, spoke on the function and organization of a sales department. Mr. Dobbins stressed the importance of an active and well organized sales force.

A recent graduate of Michigan State College, Louis Bachinski, now employed by Albion Malleable, concluded the meeting by showing slides and describing some of the modern molding equipment he is working on at the Albion plant. Bachinski's remarks were designed to give the students an idea of the type of work and training they can expect upon entering the foundry industry.

Other guests present from Albion Malleable included A. C. Hensel, personnel director, and Bruce Allen of the sales department.—*Thomas G. Thomas.*

Oregon

Featured speaker at the April meeting of the Oregon Chapter was E. J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash. Speaking on "What's New in Patternmaking and Obligation of the Patternmaker to the Foundryman," McAfee described the patternmaker as a tool maker for the foundryman. In this capacity, he advised that the patternmaker should consult with the foundryman on patterns, particularly those requiring special gating and risering, and advocated the use of models in foundry consultations.

Discussing plastic patterns, McAfee stated that they have not been satisfactory because they lack dimensional stability. However, he described new experiments with epoxy casting resins

which have proved to be dimensionally stable and show great promise. He showed slides to illustrate his talk, and displayed model patterns and samples of several new, imported woods available to the patternmaker.—*Norman E. Hall.*

Texas Chapter

Forty members and guests attended the May meeting of the San Antonio Section of the Texas Chapter held at the Alamo Iron Works, San Antonio. A film on safety practices was presented, followed by guest speaker W. G. Gumm, Linde Air Products Co., Div., Union Carbide & Carbon Corp., Houston, Texas, who discussed the use of silicones in the foundry. A general discussion period on the field of shell molding concluded the evening's program.—*Edward W. Pruske.*

Other Organizations

Reading Foundrymen's Assn.

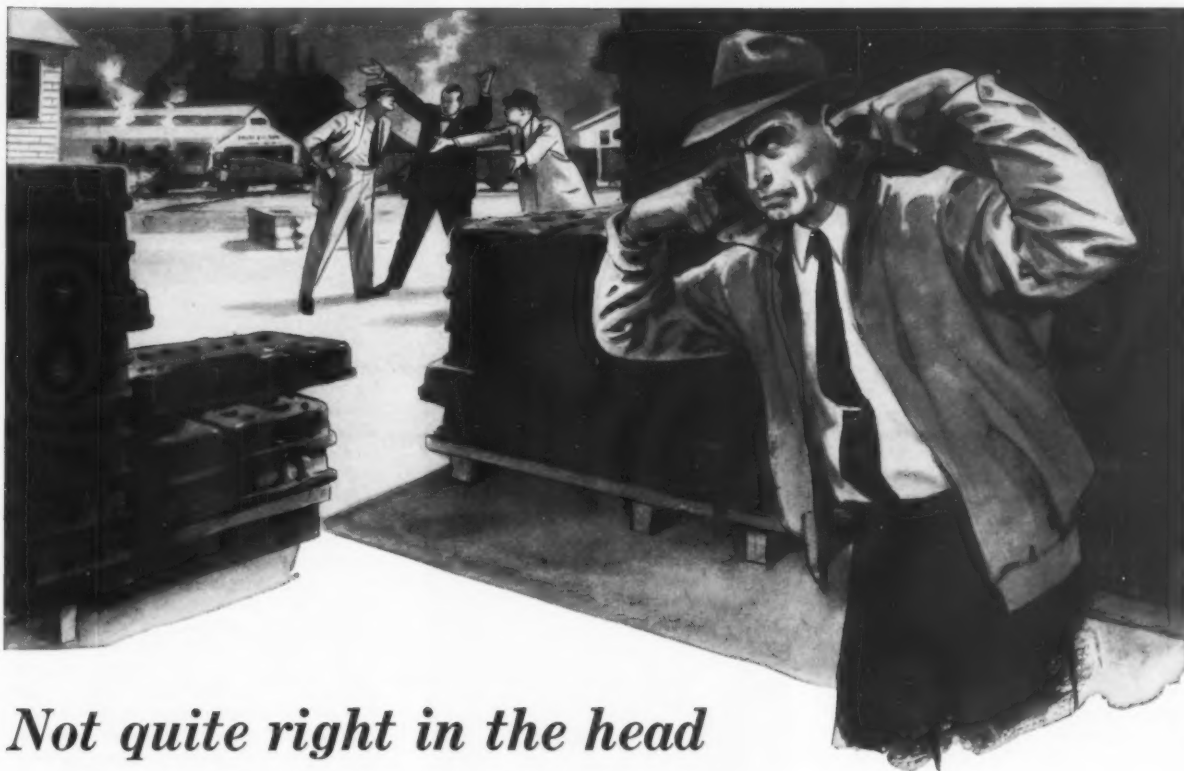
James Woodward was re-elected president of the Reading Foundrymen's Association at the annual election meeting held May 19 in the Berkshire Hotel, Reading, Pa. Other officers elected were: *vice-president*, James H. Stewart; *treasurer*, Paul K. Reiniger; *secretary*, William I. Cassidy. Howard E. Edsall, Paul B. Harner, Daniel R. Heckman, Paul C. Holland, George C. Kissell, Robert M. Schumo, and John W. Swengel were elected executive committee members.

Following the election, three panel discussions were held. Technical chairman for the steel castings discussion was Daniel R. Heckman, and Edwin A. Zebb of Dodge Steel Co., Philadelphia, was discussion leader.

George Kissell was technical chairman for the iron panel discussion, and Fred G. Sefing of International Nickel Co., New York, was discussion leader. The brass and bronze panel was moderated by David Tamor, and William H. Baer, Navy Department, Washington, D. C., was discussion leader.—*William I. Cassidy.*

Connecticut Non-Ferrous

Thomas E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago, was guest speaker at the March meeting of the Connecticut Non-Ferrous Foundrymen's Association held in the Quinnipiac Club, New Haven, Conn. Mr. Barlow spoke on "Pressure Molding." He defined pressure molding as a logical extension of green sand molding, using precise controls to achieve finer surface finishes and closer tolerances. Pressures used vary from 80 to 600 psi, depending on the type of job and the quality desired. For the most part, pressure molding employs standard molding equipment with some minor adjustments. Synthetic sands of 90 to 110 AFS fineness are favored at present, and partly rounded or sub-angular grains are used to insure better flowability. Barlow pointed out that sands with a fairly wide screen distribution seem to work better for pressure molding than types with narrow range.—*John V. McCarthy.*



Not quite right in the head

...or how Chuck Wright treats head-trouble that hurts in more ways than one

"A company I'd nominate as one of the best also came desperately close to being one of the worst," declared Chuck Wright, foundry specialist for the INCO distributor.

"I mean the Ideal Company. Before the Korean War," continued Chuck, "they poured tons of complicated cylinder head castings for Diesel engines. And to get the high strength and density needed to handle Diesel pressures they cast the heads in gray iron containing 1 to 1.5% nickel. From cupola to shipping dock, conditions of control were tops . . . rejections, minimum.

"But shortly after fighting started in Korea, rejects began piling up so fast you could almost see overhead poppin' through the ceiling. Actually, you could see Max Long, the foundry Supt., suffering from a special kind of headache. For Max paced 'round and 'round his desk, muttering to himself with gestures, like a candidate wanted by guards in white coats.

"In fact, Max and all other foundrymen who made complicated cylinder

head castings at that time began to break records for rejections. Max's soared up to 20%, and in some plants making the most complex designs, I heard they went even higher. Why? Because the foundries turned to conservation measures, including restricted use of nickel. In some iron it was dropped to .5%, but usually to no nickel at all.

"As you know, if you fill intricate molds with unalloyed gray iron, the matrix structure is primarily dependent upon the cooling rates of the various sections. Light sections cool faster than heavy ones, and surfaces cool faster than midsections. That's the reason so many of those cylinder heads showed cracks or were leakers.

"I said as much to Max. However, he refused to believe that a small addition of nickel was the answer.

"You see, in cylinder heads or any complicated designs that must withstand high pressures, you need additions of nickel back to

the old level of 1 to 1½% to get a uniform metal structure. A uniform structure minimizes rejects. And you get not only pressure tightness, but castings that are easier to machine.

"Finally he acted on my advice and returned to his pre-Korea practice of using nickel, after which rejects dropped 'way down again. I can't understand why foundrymen minimize the importance of a little nickel, or suffer so when the remedy is so simple. But that's the way it is.

"However, with rejects under control again at the Ideal Company, Max can show you how to treat head trouble. But if you want to talk to a man who gets around a lot, see me. Whatever your problem, if it has anything to do with casting, drop me a line. I'll be glad to help, anytime."

Chuck Wright

**The
International
Nickel Company, Inc.**

67 Wall Street

New York 5, N. Y.



Convention

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malleable iron in the cupola. Milton Tilley, National Malleable & Steel Castings Co., Cleveland, was chairman with W. M. Albrecht, Chain Belt Co., Milwaukee, as co-chairman. Talking on cupola melting fundamentals, Prof. R. W. Heine, University of Wisconsin, discussed air and coke requirements, pointing out that it is best to operate a cupola with optimum air and melting rates for its size. If an important change in melting rate is desired, it can best be obtained by changing the diameter of the lining rather than markedly changing the air supply.

Factors affecting the amount of coke and air that must be supplied to the combustion zone, Heine said, include the carbon supplied to the iron by the coke, the character of the coke, and the humidity of the blast.

Cupola melting practice at their respective foundries were covered by Frank L. Lopour, Belle City Malleable Iron Co., Racine, Wis., and R. H. Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich. Duplexing for railroad grade malleable iron, Lopour said, is influenced by the use of more oxidizing conditions than in production of gray iron, and by wide variations in metal requirements from hour to hour in a mechanized jobbing shop. He described operation of two internally water-jacketed cupolas arranged so either could supply metal to either of two air furnaces. Cupolas are operated on alternate days, he said, with air furnaces operated on alternate weeks. Control of duplex operations includes both metallurgical staff supervision and on-the-job supervision. In his company's operation, said Lopour, on-the-job control starts with cupola slag color (green or at point where color changes from black to green), which is principally a function of bed height as related to blast volume.

Second point of control, Lopour stated, is metal temperature (2800 to 2850 F) though changes in operating conditions are usually indicated by change in slag color first. Because it takes from two to six hours for material charged to affect analysis at the air furnace spout, variables must be evaluated and allowed for as early as possible, he pointed out.

Second of the Malleable Shop Courses was held on Tuesday afternoon, May 11, under the chairmanship of Eric Welander, John Deere Malleable Works, East Moline, Ill. William Zeunik, National Malleable & Steel Castings Co., Indianapolis, was vice-chairman.

With a discussion of "Malleable Annealing Practice," the session featured a panel composed of J. T. Bryce, Albion Malleable Iron Co., Albion, Mich.; F. W. Jacobs, Texas Foundries, Inc., Lufkin, Texas; and L. R. Jenkins, Wagner Malleable Iron Co., Decatur, Ill.

Using a series of slides, Mr. Jacobs

first presented a brief summary of malleable iron annealing practice. He outlined the various stages in annealing cycles and delineated accepted commercial practice in each.

The panel discussed annealing furnace types used in their plants and results obtained with various production operations. The radiant tube continuous furnace was said to be versatile in handling pearlitic and to afford high production output. Lower cost per ton of castings was offered as the principal advantage of the bell-type furnaces used by several of the panel members. Superior control of warpage is possible with batch-type ovens, which materially re-



Robert Gregg, American Meter Co., Inc., and Mrs. Gregg at the showing of their film of an overseas tour to the people in the Cleveland area from the Isle of Man, which is Mr. Gregg's birthplace.

duce the problems of stacking and straightening. Other furnaces generally require dies for straightening castings after they have been annealed.

Most of the panel agreed that they heat-up as fast as possible to the first critical stage. A controlled CO-CO₂-N atmosphere was universally accepted as the best for commercial operating procedure.

W. D. McMillan, International Harvester Co., Chicago, showed slides to illustrate the effect of furnace atmosphere conditions on casting surface. Concluding the panel discussion, test procedures, temperature control and quenching procedure were treated in detail. The meeting was then opened to questions from the floor.

Presiding at the Malleable Round Table Luncheon Tuesday, was J. H. Lansing, Malleable Founders' Society, Cleveland. Frank Rote, Albion Malleable Iron Co., Albion, Mich., started the meeting by outlining tentative plans for the Malleable Division's program at the 1955 convention.

Subject at the luncheon was "Effective Use of Melting Controls in Duplex and Direct Furnace Melting." Speakers were E. T. Price, Cadillac Malleable Iron Co.,

Cadillac, Mich., and L. E. Emery, Marion Malleable Iron Co., Marion, Ind.

Mr. Price discussed the use of a recuperator or heat exchanger in conjunction with a pulverized coal fired air furnace which has been in use at his plant for 24 years. The savings in fuel alone has paid for the installation and maintenance of the recuperator many times over, he said. Advantages claimed for this type of equipment are savings in fuel and shorter melting time resulting in less oxidation, lower sulphur pick-up and greater refractory life.

The principle of operation makes use of the waste heat in the exhaust furnace gases to preheat the secondary air used for combustion, he said. Preheated air is mixed in the burner with the primary air and pulverized coal. This heated mixture of coal and air promotes more rapid and more complete combustion of the coal especially near the burner. The flame is a hotter, more uniform and efficient melting flame and complete combustion within the furnace is assured. Tests made by outside combustion engineers, Mr. Price claimed, show practically perfect combustion.

Mr. Emery, second speaker at the luncheon, spoke on "Combustion Control on an Air Furnace," and pointed out that good control consists of anticipating difficulties. By use of colored slides he showed how his company kept furnace control records, records on slag and humidity control. Heat prover and controls are used by his firm and test bars are poured every hour, he said.

STEEL

FEATURING three technical sessions and a Round Table Luncheon, the steel program was concentrated in the last three days of Convention week.

The Wednesday afternoon steel session, devoted to hot tears, included: "Stress Required to Hot Tear Plain Carbon Cast Steel—Effects of Tearing Temperature, Composition, and Deoxidation Practice," H. K. Bhattacharya, C. M. Adams, Jr., and H. F. Taylor, Massachusetts Institute of Technology; "Influence of Core Material on Hot Tearing of Steel Castings," a progress report on the AFS steel research project by Steel Research Committee Chairman C. H. Wyman, Burnside Steel Foundry Co., Chicago; a further report on the project, entitled "Metallurgical Investigation at Armour Research Foundation," by J. W. Giddens, Armour Research Foundation, Chicago; and a panel discussion of problem castings and the elimination of hot tears in them.

Mr. Wyman was session chairman; vice-chairman was John A. Rassenfoss, American Steel Foundries, East Chicago, Ind. Panel members were: H. H. Blois, Minneapolis Electric Steel Castings Co., Minneapolis; J. B. Caine, Cincinnati foundry consultant; W. S. Pellini, Naval Research Laboratory, Washington, D.C.

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Mr. Rassenfoss; C. M. Adams, Jr., Massachusetts Institute of Technology; C. J. Zilch, Bucyrus-Erie Co., South Milwaukee, Wis.; and B. C. Yearley, National Malleable & Steel Castings Co., Cleveland.

Mr. Bhattacharya evoked considerable discussion with his description of a test casting and load cell developed to measure stresses in a steel casting cooling under conditions of hindered contraction. Hot tearing of steel occurs at austenite grain boundaries, he reported, and differences in tearing behavior, which depended upon composition or deoxidation practice, manifested themselves only at temperatures below the solidus. Temperature of tearing depends upon timing and severity of resistance to solid contraction, may occur after complete or partial solidification, and can occur as low as 1700 F.

Mr. Giddens reviewed Armour's metallographic and chemical studies of the hot tear test castings made by eight cooperating foundries participating in the AFS hot tear project. Metallographic examination shows, he said, that in all hot tears heavy oxidation and a considerable amount of porosity existed. Some castings showed as much evidence of shrinkage as of hot tearing. Fractures were both transgranular and intergranular. A wide range of metal compositions were represented in the tests, Giddens explained, and analyses had not yet shown whether or not chemistry was a factor in hot tearing.

To conclude the session, Mr. Wyman illustrated problem castings reported by various foundries by means of slides, gave production conditions and problems, and called on panel members and the audience for opinions on how to eliminate hot tears. Solution to a number of hot tear problems seemed to be the use of a soft core and the following mix, used on the hot tear research project, was suggested: No. 63 sand, 1.1 per cent cereal, 2.1 per cent iron oxide, 0.6 per cent wood flour, 0.9 per cent water, and 1.1 per cent core oil.

Proper location of gates also came in for consideration along with use of brackets, cracking strips, and chills. Proper design was emphasized as well as careful location of risers. Other solutions to hot tearing were use of rebar bars, softer ramming, and substitution of green sand for dry sand cores.

A steel session was held on Thursday morning, featuring two papers. J. R. Patton, General Steel Casting Corp., Granite City, Ill., presided; vice-chairman and secretary was J. H. Janssen, Pratt & Letchworth, Buffalo, N. Y.

C. F. Christopher, Continental Foundry & Machine Co., East Chicago, Ind., presented his paper, "Effect of Pouring

Temperature on the Soundness and Physical Properties of Steel Castings." Steel temperature as it enters the mold controls or influences the solidification pattern, strength of the deoxidizers present, and, indirectly, oxygen level at the time; and, when the steel begins to freeze on the mold wall, it is the temperature of pouring and its deoxidizer influence on oxygen that determine susceptibility to porosity and iron sulphide precipitation.

High-temperature pouring, Christopher said, automatically leads to detrimental deoxidation practices in order to avoid porosity, requiring expensive deoxidizers and rectifiers. Some foundries, he stated, deoxidize with silicon alone, others use silicon and aluminum for the same purpose. Others may use calcium, cerium, titanium, cerium oxide, lanthanum, calcium-manganese, silicon, or other agents. Deoxidizing can be detrimental either to steel quality, or to the pocket-book if overdone. Christopher also dealt with the relationship between oxygen levels and the types of inclusions formed, and methods used to rectify bad inclusion types, or to avoid them.

M. V. Herasimchuk, Bethlehem (Pa.) Steel Co., offered a paper designed to show foundrymen how to classify equipment failures as to design or metallurgical problems. Using the title, "Why Did It Fail?" he showed that design, material, and applied loads are the three components affecting the performance of industrial equipment. Improper balance of these components, he said, will produce short life, high maintenance cost, lower production rate, and high accident potential.

Herasimchuk suggested procedures for analyzing equipment failures, citing case histories. Repetitive failures on large pieces of equipment often create situations that keep design engineers working overtime trying to correct problems that rightfully belong to the metallurgists, he stated.

Closing steel session was held Friday morning under the chairmanship of B. C. Yearley, National Malleable & Steel Castings Co., Cleveland, with R. A. Willey, Commercial Steel Casting Co., Marion, Ohio, as vice-chairman and secretary.

W. S. Pellini, Naval Research Laboratory, Washington, D. C., in a paper, "Factors Which Determine Riser Adequacy and Feeding Range," reviewed the important work he has been doing in steel research. The casting itself must be designed for proper feeding, he said. "Feeding distance must be built in."

Centerline shrinkage must be controlled through proper riser positioning, Pellini declared. He reviewed the patterns of directional solidification and the resultant effect on shrinkage in steel castings. Chills will help reduce shrinkage if judiciously used and positioned between risers. In addition, he stated, chills will reduce the number of risers needed to feed a casting and will generally extend their range.

Pellini outlined the principles determining riser design in the casting of steel, as specified in work done in the Naval Research Laboratories at Washington,

D. C. He showed that sound castings can only result from engineered feeding systems, and that arbitrary improvisation cannot consistently produce a quality product.

"Design and Operation of a Modern Heat Treating Department," was the subject of a paper by R. W. Wilson, American Hoist & Derrick Co., St. Paul, Minn. Layout of such a department requires a detailed description of all processes and operations that will be included in the section, including material specifications of work to be treated, physical properties desired, special quality requirements, and general size and shape of the castings. Strict attention to details at this stage cannot be overly emphasized, said Wilson.

Furnaces, quenching system, and materials handling equipment must all be integrated into a smoothly-operating department, the author said. He then described the design of a heat treating installation intended to handle annealing of low alloy cast gears, hardening and tempering of carbon and low alloy steel castings, and stress relieving of certain gray iron castings. Although individual conditions would vary from plant to plant, Wilson asserted, the broad principles would remain relatively applicable. He discussed processes in particular to show how they form the framework for the design of a modern heat treating department.

The Steel Round Table Luncheon was held Thursday noon, with V. E. Zang, Unitcast Corp., Toledo, Ohio, presiding. Subject for discussion was: "Now There's a Good Question."

The topic under immediate consideration was hot tears and a suggestion was made that "they don't take place in the furnace." Hydrogen and nitrogen could have an effect on the incidence of hot tears, according to one opinion. Another suggested that 15 points of carbon reduction is as good as 30 in reducing hot tears.

A question was raised as to the availability of any material for increasing hot strength or surface chilling. It was reported from the floor that ethyl silicate has been used for that purpose. Casting of steel in shell molds entered the discussion, with problems encountered in the process presented by the audience. Stainless and high alloy steels are being successfully cast in shell molds, it was reported.

DUST CONTROL AND VENTILATION

THREE technical sessions were sponsored by the Safety, Hygiene & Air Pollution Committee. Each meeting covered a different phase of the activity: dust control and ventilation on Tuesday, safety on Wednesday, and air pollution at the closing meeting on Thursday.

R. S. Dahmer, Eaton Mfg. Co., Vassar, Mich., presided at the Tuesday session. W. W. Dodge, Caterpillar Tractor Co.,

Peoria, Ill., was vice-chairman; A. S. Lundy, Claude B. Schneible Co., Detroit, acted as secretary.

J. R. Allan, International Harvester Co., Chicago, chairman of the division steering committee, opened the program with a progress report. He stressed the fact that the frequency rates shown on present data are too high and not typical of the facts. The Safety Committee, he said, is working on this problem, and trying to induce foundries to report their records in order to provide a truer picture of the frequency rate of accidents for the industry.

Allan referred to the manual being planned by the Dust Control and Ventilation Committee. The program presented at the Convention was based on this material, he stated. The second section of the manual has been printed; two other sections will be available soon after the Convention. Title of the booklet will be *Engineering Manual for Foundry Health Control*.

Reference was also made to the manual now nearly completed by the Air Pollution Control Committee. Allan spoke about the work being done by the Noise Abatement Committee and the Welding Committee, and listed the educational activities being conducted in cooperation with AFS chapters.

"Foundry Hygiene Problems" was the

topic of a paper presented by H. J. Weber, American Brake Shoe Co., Chicago, who warned that the forthcoming AFS manual should not be regarded as a code since local governments have varying regulations. Weber recommended pre-placement physical examinations, with re-examination annually. Adequate first-aid facilities are a necessity also, he said. He devoted most of his time to a listing of metals, chemicals, and other agents used in the foundry, and the dangers likely to occur from handling them.

B. B. Bloomfield, Department of Health, State of Michigan, Lansing, presented a demonstration of the principles of foundry ventilation, using artificial smoke and pipes which substituted for the ventilating ducts used in a foundry. He also illustrated the effects of hooding to control dust with miniature fans which showed the pattern of air movement within the room. A floor discussion followed the demonstration with a pall of artificial smoke charging the atmosphere and providing an excellent background for the subject being treated.

The program also included a paper, "Principles of Exhaust Ventilation," by W. W. Dodge, Caterpillar Tractor Co., Peoria, Ill., who showed slides depicting how hoods can be improvised and used to advantage on these problems. F. C. Fluegge, International Harvester Co.,

Chicago, discussed the application of ventilation equipment to sand handling.

T. J. Glaza, Crane Co., Chicago, presented results of theoretical studies which show that predictions can be made as to how long it will take to cool castings down to 140 F, where they can be safely and comfortably handled by foundry workers. Information of this type, Glaza said, has not been available to the foundry industry, but a compilation of such data would enable better control of the heat problem. Title of Mr. Glaza's paper was: "Cooling of Castings."

The session was closed with a discussion of the principles of effective maintenance of foundry ventilation and dust collecting equipment by K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

The safety session was held on Wednesday afternoon, May 12. J. W. Young, International Harvester Co., Chicago, presided; vice-chairman and secretary was P. W. Olson, Eaton Mfg. Co., Vassar, Mich.

E. C. Hoenicke, Eaton Mfg. Co., Detroit, opened the meeting with a paper on "Value of the Safety Program to the Foundry." He demonstrated with dollars-and-cents figures the value of safety to a foundry operation, and how control of the incidence of accidents can result in a saving in labor, and in cost of insurance. A workable safety program, Hoenicke said, is advantageous both from the

Calendar of Future Meetings and Exhibits

July

13-15 . . Western Plant Maintenance Conference & Show
Pan Pacific Auditorium, Los Angeles.

August

9-14 . . Short Course: Cast Metals in Engineering Design—Fundamentals

Cast Metals Laboratory, University of Michigan, Ann Arbor, Mich.

16-20 . . Short Course: Cast Metals in Engineering Design—Application

Cast Metals Laboratory, University of Michigan, Ann Arbor, Mich.

September

13-25 . . First International Instrument Congress & Exposition
Philadelphia Convention Hall, Philadelphia, Pa.

19-26 . . Associazione Italiana di Metallurgia

Florence, Italy. 21st International Congress of Foundry Technical Associations.

27-28 . . Steel Founders' Society of America

The Greenbrier, White Sulphur Springs, W. Va. Fall Meeting.

October

6-8 . . National Foundry Association
La Salle Hotel, Chicago. 56th Annual Meeting.

14-15 . . Michigan Regional Foundry Conference

Ann Arbor, Mich.

14-16 . . Foundry Equipment Manufacturers' Association

The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

15-16 . . Northwest Regional Foundry Conference

Vancouver, B. C., Can.

16-19 . . Conveyor Equipment and Manufacturers' Assn.

The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

27-29 . . Grinding Wheel Institute & Abrasive Grain Association

Edgewater Beach Hotel, Chicago. Fall Meeting.

28-29 . . Metals Casting Conference
Purdue University, Lafayette, Ind. Sponsored by Central Indiana and Michiana Chapters of AFS and Purdue University.

28-30 . . Canadian Conference
Toronto, Ont., Can.

29-30 . . New England Foundrymen's Assn.

Massachusetts Institute of Technology, Cambridge, Mass.

November

1-5 . . National Metal Congress, National Metal Exposition

Palmer House, Chicago.

3-6 . . American Council of Commercial Laboratories

Roosevelt Hotel, New Orleans, La. Annual Meeting.

11-12 . . Gray Iron Founders' Society
The Homestead, Hot Springs, Va. Annual Meeting.

29 . . First International Automation Exposition

242nd Coast Artillery Armory, New York.

December

1-4 . . American Institute of Mining & Metallurgical Engineers

Hotel William Penn, Pittsburgh, Pa. Electric Furnace Steel Conference.

February (1955)

10-11 . . Wisconsin Regional Foundry Conference

Hotel Schroeder, Milwaukee.

economic and the humanitarian standpoints.

"The Camera Aids Our Housekeeping and Inspection Program" was the title of a paper by Harold Zuehlke, Allis-Chalmers Mfg. Co., Milwaukee. Candid camera shots are used in his plant, showing poor housekeeping practice, then posted on the bulletin board. Corrective action is rapid with this method. Later, another candid photo is made and the "before and after" pictures are both placed on the board.

Zuehlke reported that this program has helped implement their safety program, and that many hazardous conditions have been detected in the photographs and corrected before accidents occurred. The program, he said, demonstrates that any good safety technique is primarily preventive in scope, eliminating causes of accidents before they happen.

No speaker, said T. A. Kraklow, can draw up a detailed blueprint that will provide the maximum results in safety activities. Mr. Kraklow, Deere & Co., Moline, Ill., presented a short paper, "Training in Accident Prevention," placing a prime responsibility for safety on the supervisor, who, too often, feels that his job is only "getting out production." Accident prevention and production efficiency go hand-in-hand, Kraklow said. "... if we would get people to do their jobs in the way they should be done, that is all there is to accident prevention."

R. L. Berger, Belle City Malleable Iron Co., Racine, Wis., next presented a paper: "Protective Equipment." He stated that there is a direct relationship in the foundry between methods of handling protective equipment and a low frequency and severity rate in accidents. Equipment that should receive the most attention includes safety glasses and goggles, safety shoes, gloves, sleeves, and leggings. The respirator, Berger said, once of paramount importance in the foundry, should not have to be used on a production job at all today. Berger reported that a survey that he conducted had shown a direct relationship between frequency of accidents and use of safety equipment in the plants queried.

Gordon White, Central Foundry Div., General Motors Corp., Saginaw, Mich., presented a film, "Engineering Safety Into New Methods," supplying the narration himself. Many possibilities for the installation of safety devices were shown, and Mr. White explained how such methods are used at Saginaw to increase production and prevent accidents, all of which is good business practice.

The air pollution control session was held on Thursday afternoon with F. A. Patty, General Motors Corp., Detroit, presiding. K. M. Smith, Caterpillar Tractor Co., Peoria, Ill., was both vice-chairman and secretary.

A. G. Tompkins, Lufkin Foundry & Machine Co., Lufkin, Texas, reported his company's experiences with a comparatively inexpensive cupola collector. The paper, "Experiences With the Use of a Spray Type Collector on a 72-in. Cupola," described equipment which has

been in use since April, 1953. Advisability of using this type collector on a cupola, Tompkins said, would depend primarily on the required collecting efficiency. This type installation will meet any code except the Los Angeles County Air Pollution Control Ordinance.

Use of the spray-type collector has eliminated the need for cleaning the foundry roof several times per week, and minimized any pollution of the air in the working areas of the foundry, or in the immediate neighborhood.

R. M. Ovestrud, Minneapolis-Moline Co., Minneapolis, in his paper, "Cupola Fly-Ash Suppression," presented useful information on the maintenance and treatment of water used on wet collectors in order to prolong the life of the equipment. Precautionary measures of this type, he said, can eliminate many of the troubles encountered by foundrymen with collectors on the cupola. Simple water-treatment methods, which he described, have reduced the maintenance problem at his plant to a minimum.

"Cupola Emission Control" was discussed by Otto Brechtelsbauer, Chevrolet-Saginaw Gray Iron Foundry, General Motors Corp., Saginaw, Mich. He reviewed the development of the cone installations in a wet collector, which are used to provide better washing spray. General Motors had installed a wet washer at the Buick foundry before the war and additional equipment was added after 1945.

Brechtelsbauer warned about difficulties with nozzles on cones and showed how his plant had finally developed a new, satisfactory type. After seven years' use, he said, the washers are beginning to corrode and will require corrective maintenance.

Lawrence Krueger, Pelton Steel Foundries, Milwaukee, listed the reasons why his plant had installed control equipment on its electric furnace, in a paper, "Control of Emissions for the Electric Furnace." The inclusion of an additional collector prevented emission from polluting the atmosphere, he said, thus complying with an air pollution ordinance recently adopted in his city. The equipment was developed in the plant.

PATTERN

TWO technical sessions and a round table luncheon comprised the Pattern Division program, covering the first three days of the week.

First paper at the session, "Blow-in Driers," was presented by R. W. Wendt, Industrial Pattern & Mfg. Co., Inc., Chicago. He traced recent efforts to improve the making of cores by reducing the handling of equipment wherever possible. Improvement of core binders and mixes to reduce baking time and provide better breakdown and releasing qualities, has made it possible to blow cores directly into driers.

These "Blow-in" driers, he said, are nothing more than improved shell driers. Wendt outlined other core production methods in current use, pointed up the

demand for close dimensional tolerances. Blow-in driers, he said, meet these requirements, produce excellent results with either bulky or small, intricate cores. Closer tolerances will reduce wall section thickness and machining stock. Eliminating parting line separations, they also minimize parting line patching. "Precision cores," Wendt concluded, "make precision castings."

The frozen mercury process, the first meeting was told by I. R. Kramer, Mercast Corp., New York, should be considered an extension of the precision casting field. In a paper titled, "Investment Casting by the Frozen Mercury Process," he said that it affords a method for casting more complex and larger shapes than can be handled by other methods.

Liquid mercury is poured into a steel die at room temperature, then frozen at -100 F. In the author's process, the die is lowered into a dry ice-acetone mixture which permits the freezing to progress from bottom to top of the pattern. Very thin sections can be filled with liquid mercury, he said, and rate and direction of solidification can be easily controlled by rate of submergence of the die.

One of the greatest advantages of frozen mercury as a pattern material for investment castings, declared Kramer, is its weldability, allowing the making of complex-shaped castings. The process is accomplished simply by touching two pieces of frozen mercury together and pressing slightly. The self-welding property is useful also for freezing the casting and individual gating and risering systems separately, then joining together by the process mentioned.

An important advantage of mercury over wax is the volume change characteristic, about 3.47 per cent, compared with 9 per cent. This small volume change during melting out of the mercury pattern from the ceramic mold produces less distortion and strain. Where wax process dimensions do not usually exceed 6 in., the author's process regularly produces dimensions in excess of 42 in., weighing over 300 lb, he stated.

Unlike other investment casting methods, the frozen mercury process uses a thin shell mold into which the molten metal is cast. The mold is made by dipping the mercury pattern into a ceramic slurry. These molds are fired and may be stored indefinitely. Other advantages, Kramer concluded, are that cores are more easily removed, and ceramic molds are unreactive with molten metals.

The Tuesday afternoon Pattern session was held with V. C. Reid, City Pattern Foundry & Machine Co., Detroit, in the chair; assisted by vice-chairman and secretary J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn.

Using a series of 14 slides, O. C. Bueg, Arrow Pattern & Engineering Co., Erie, Pa., presented an illustrated paper on, "Pattern Equipment for Shell Molding." Size of shell moldings has not been finally determined, he said, but it should not be thought that they are only practical for small production. The possibility

of obtaining more castings per square inch gives plate arrangement more importance than in conventional methods. Accuracy, Bueg stated, may be impaired by the lack of uniform contraction because of slow disintegration of the shell after the metal has been poured. This differential will have to be designed into the pattern, he remarked.

Bueg reported that his experience shows horizontal pouring generally provides a better shell mold casting, unless time and labor are available to experiment with gating arrangements for vertical pouring. Because the shell becomes a homogeneous unit, less draft can be used in making shell mold patterns, and removal of the shell from the pattern does not present as much of a problem.

The Tuesday afternoon session also featured a paper by W. C. H. Dunn, Western Pattern Works, Inc., Montreal, Que., Canada: "Use of Plastics in Patternmaking." The plastic family is not new, Dunn said, but dates from the beginning of the century. However, they were not used in the pattern field until 1940. Thermosetting plastic combinations are the types used in casting patterns. Once set, their form is permanent and rigid; and they have dimensional stability, durability, and controllable shrinkage.

Dunn described the patternmaking process, covering plaster mold production, preparation of the resin mix, pouring, curing, and sanding. He listed the advantages claimed for plastic patterns and outlined typical applications. These patterns, he concluded, offer low-cost duplication, eliminate finishing requirements, are identical with master patterns, need no shrinkage compensation, do not require and assure minimum surface wear.

At the Round Table Luncheon Wednesday, A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, presided and H. J. Jacobson, Industrial Pattern Works, Chicago, acted as vice-chairman. "Accuracy and Tolerances for Patterns," was the subject of George Webber, Webber Gage Co., Cleveland, speaker at the luncheon. He discussed the origin of measurement and pointed out how a change in the gauge block theory at one time caused confusion in industry. Students from the Cleveland Trade School attended the discussion part of the luncheon meeting. A question and answer period followed Mr. Webber's talk.

EDUCATION

THREE meetings were held by the Educational Division on Tuesday, May 11. Included were a round table luncheon and two technical sessions.

W. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind., presided at the round table luncheon, assisted by W. H. Ruten, Polytechnic Institute of Brooklyn.

In the transition of the foundry industry from art to science, we have



At the Tour D reunion party G. E. Seavoy, Whiting Corp., host, right, greets W. G. Ferrell, Auto Specialties Mfg. Co., and Mrs. Ferrell, as Robert Roncey of France looks on.

created a group of specialists for increasing production and lowering costs, according to B. C. Yearley, National Malleable & Steel Castings Co., Cleveland. He spoke to the luncheon meeting on "Human Engineering," and told his audience that we are running out of a resource of manpower that, in the past, could be trained for line supervision. Therefore he said, it is necessary to develop a program to attract the young man below the college level and offer him training in the industry.

While the task is a cooperative one and requires the assistance of educational institutions, the industry must take the first step in securing their aid.

The novice can learn foundry skills more easily if he is made to feel that he is a part of the over-all program, said Arthur Agostini, Grede Foundries, Inc., Milwaukee. Speaking on "A Short Course in Foundry Skills," Agostini told the first afternoon session. F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill., presided. Vice-chairman was W. F. Graden, Simonds Abrasive Co., Philadelphia.

Stressed Teaching-By-Doing

Mr. Agostini stressed that a program of teaching-by-doing is most effective, and cited the case of nine men who were taught squeezer operations within a few days. In addition to congenial working conditions, an opportunity must be present for employees to advance within the organization.

Motivation, Agostini said, can contribute importantly to efficient labor operations. Workers should be led by a supervisor who isn't loath to dirty his hands. A successful training program must be put on a personal basis and not administered from behind a desk in the front office.

Final session in the Educational series was headed by F. G. Seifing, International Nickel Co., New York; assisted by vice-chairman E. M. Strick, Erie Malleable Iron Co., Erie, Pa.; and sec-

retary G. J. Barker, University of Wisconsin, Madison.

A five-man panel discussed the question: "What Does the Foundry Industry Want AFS to do in Educational Work on the Local Chapter Level?" Participating were: R. M. Reese, Trade and Industrial Education Section, State of Ohio, Columbus; H. E. Mandel, Pennsylvania Foundry Supply & Sand Co., Philadelphia; E. M. Strick, Erie Malleable Iron Co., Erie, Pa.; B. C. Yearley, National Malleable & Steel Castings Co., Cleveland; and, A. B. Sinnott, AFS headquarters, Chicago.

Better Understanding Needed

The panel and floor discussions developed the point that the industry wants AFS to develop within the communities and their high schools a better knowledge of the metals casting industry. This work, according to the consensus, should be done through the local chapters.

Before the public will accept the foundry as a good place to work, the collective mind must be disabused of the idea that a casting plant is a black hole. Too many people know too little about the industry and the Society and its members must educate them to a level commensurate with present-day operations.

PLANT & PLANT EQUIPMENT

THE Plant & Plant Equipment meeting was held on Wednesday afternoon, May 12. In the chair was James Thomson, Continental Foundry & Machine Co., East Chicago, Ind. H. W. Johnson, Wells Mfg. Co., Skokie, Ill., served as vice-chairman and secretary of the session.

Opening paper, by W. R. Jaeschke,

Whiting Corp., Harvey, Ill., was titled, "Development of Cupola Melting Equipment." The author reviewed the history of cupola equipment in the foundry, starting with the early 18th century. J. H. Whiting was producing cupolas with two rows of tuyeres, about 1875, soon introduced the flared tuyere, a safety tuyere, and pressure gauge.

The British balanced blast type cupola was described, and solutions to charging problems were outlined. Use of overhead cranes in American foundries after World War I was the first definite improvement in charging technique. Jaeschke said that hot blast equipment, long proposed, has received general consideration only recently. He pointed out the development of dust suppression equipment and the increasing use of safety devices. While he did not try to forecast the future accurately, the author said that cupolas will be mechanized and automated to a high degree, and that more closed-top cupolas of various design will be used, including bell and double bell tops, and more recuperative types of preheaters where waste gases must be cleaned.

Most difficulty in controlling emissions from foundry equipment in the past has been associated with melting operations, said D. E. Gilchrist, Deere & Co., Moline, Ill., in a paper: "Air Pollution Control Equipment for the Cupola." He pointed up the problem facing all industry and the danger of highly restrictive legislation.

Since melting in the foundry combines high temperature, excess gases, and high dust loading of sub-micron particles, effective dust and air pollution control equipment has been extremely costly. Gilchrist reported in his paper on progress made in this field to date.

Most of the material charged into a cupola furnace, he said, is dusty by nature. Combined with air expansion when it is forced through tuyeres, strong velocities are developed and these particles are carried into the atmosphere.

Equipment is available today, he continued, that will pass any existing code in air pollution control. Gilchrist reviewed briefly the existing types of equipment: screen cages, centrifugal and inertia types, centrifugal scrubbers, bag filters, electrostatic precipitators, waste heat recuperators, and wet washers.

Choice of equipment, Gilchrist cautioned, may be influenced by ordinance in specific localities, as in the Los Angeles area. Only rarely, however, have governmental demands made it impossible to install more economical equipment for air pollution control. An average code requirement specifies equipment that will prevent a discharge of about 85 lb solids per thousand lb effluent gas—not a severe ordinance.

Even if the area does not have restrictive codes, it is the obligation of the foundrymen to cooperate with the community in controlling air contamination since the problem is constantly becoming more acute and is spreading to new regions as industry moves out from concentrated manufacturing centers.

REFRACTORIES

ONE technical session and a Shop Course were sponsored by the Refractories Committee. W. R. Jaeschke, Whiting Corp., Harvey, Ill., presided at the first session. R. A. Witschey, A. P. Green Fire Brick Co., Chicago, served as vice-chairman and secretary.

J. H. Rickey, Jr., Ironton (Ohio) Fire Brick Co., discussed "Economic Considerations in Refractory Ladle Practice." In his paper, he pointed out that, although the volume of refractories used in a foundry is relatively small, their effect upon castings may be extremely great. Four factors were listed as of primary importance in determining what ladle lining to use: initial cost of refractories, cost of installation, length of service obtained, and the effect of the refractory lining on the metal being poured.

Rickey described the various types of ladles in use and the refractories that work best for them. Whatever the material used, he cautioned, care in making the installation and bringing it safely up to operating temperature cannot be over-emphasized. Venting and pre-heating procedure were outlined in Rickey's paper. He referred to several new refractory materials made of plastic base and indicated the fields in which they may find their most useful application.

Based on a previous paper that showed that bottom life could be predicted by measuring bottom temperature, a paper on, "Correlation of Air Furnace Bottom Temperature to Refractory and Operating Practice in a Cupola-Air Furnace Duplex System," was presented by F. W. Jacobs, and E. C. Ashley, Texas Foundries, Inc., Lufkin, Texas. The authors emphasized the treatment and control of slag on the furnace bath and made reference to practical control procedures. They used graphs to compare results and show differences in retained bottom temperatures, as related to size and type of brick, variable construction and operating methods, and intermittent operation of the furnace.

Generally, Jacobs and Ashley reported, for each bottom, the higher the maximum temperature recorded, the less good bottom brick remaining. Excess furnace flame turbulence, they said, can spall the bottom brick in the front half of the furnace, leading to metal scabs on the bottom, and lower bottom life. They found that adjusting the slope of the front half of the bottom to better coincide with the angle of flame impingement will reduce or eliminate spalling. Controlled slag treatment on an oil-fired furnace bath is a major factor for increasing bottom life, with resultant lower cost of refractory per ton. Proper precaution, the authors concluded, is necessary to prevent cupola slag from draining onto the furnace bath.

Staged for the first time this year was a Refractories Shop Course with a panel discussing "The Importance of Refractories in Your Foundry" and answering questions from the audience.

Chairman of the session was R. H. Stone, Vesuvius Crucible Co., Pittsburgh, Pa.; vice-chairman and secretary was Walter R. Jaeschke, Whiting Corp., Harvey, Ill. Others participating in the panel were: Ralph Carlson, American Cast Iron Pipe Co., Birmingham, Ala.; L. D. Christie, Jr., Babcock & Wilcox Co., New York; A. H. Thompson, Canadian Refractories, Ltd., Montreal, Que.; R. A. Witschey, A. P. Green Fire Brick Co., Chicago; and F. H. Fanning, Harbison-Walker Refractories Co., Pittsburgh, Pa.

Mr. Fanning opened the session with a talk on fundamentals of refractories. Mr. Carlson outlined cupola refractory practice problems and practical methods of overcoming them. Malleable melting and annealing as related to refractories were covered by Mr. Witschey while Mr. Christie discussed ladle and forehearth. Mr. Thompson's subject was refractories in steel foundry practice.

HEAT TRANSFER

THE Heat Transfer Committee sponsored two technical sessions, offering five papers on Wednesday and Thursday, May 12 and 13.

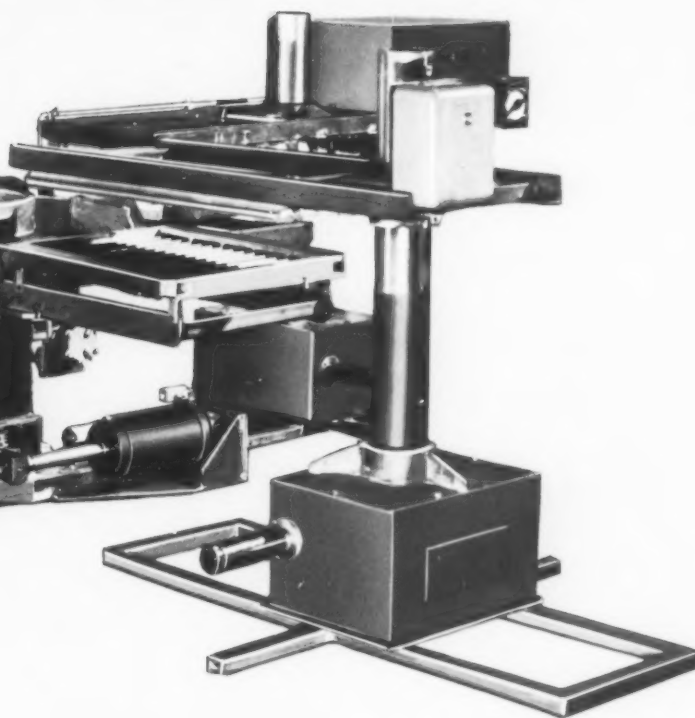
W. A. Mader, Oberdorfer Foundries, Syracuse, N. Y., presided at the first session. Vice-president and secretary was R. C. Shnay, Dept. of Mines & Technical Surveys, Ottawa, Can., V. Paschkis, Columbia University, New York, presented an AFS Heat Transfer Project Report: "Solidification of Finite Cylinders." His work was an extension and completion of the 1953 report, with investigations limited to the casting itself. Using the convenient "Reimann temperature" as a point of departure, Paschkis plotted his results in the form of isochrones, which are curves connecting all points in a system which reach a certain temperature at the same time. Freezing times were then correlated as functions of the geometry of the casting involved.

The solidification of the center of a "very long cylinder" is not influenced by the cooling of the end faces, the author stated. If the length is greatly decreased, solidification conditions approach those of the slab. In the latter part of his paper, Paschkis reported a deviation in his findings from the Chvorinov Relationship, vindicating certain results in that direction in the investigations of Pellini. In seeking a simplified expression, he said that the solidification time of a casting can be considered as an expression of resistance to heat extraction from the casting.

R. E. Morey, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C., conducted investigations aimed at establishing data of comparative heat transfer characteristics of shell molds in comparison with sand molds for a variety of metals. Results were reported in a paper: "Heat Transfer Characteristics of Metals Cast in Shell Molds." Effects of variations in shell mold practice continued on page 101



THE NEW SHELL **FORMATIC** *presents a new concept in shell molding machines*



Now it's possible for a foundry to make a *modern* shell mold machine installation with an initial investment of only a little more than that required for crude ineffectual dump box equipment. The new B&P shell Formatic machines feature "unit package" construction. The foundry starting on their shell molding program can install only those components that are actually necessary. Then they can add units and features as their program is enlarged, and so pay for their shell molding mechanization with shell molding profits.

The simple "unit package" components offer all of the important features of the complete rotary unit illustrated. These include fully automatic sand box, curing furnace, and stripper unit controls. The complete auto-

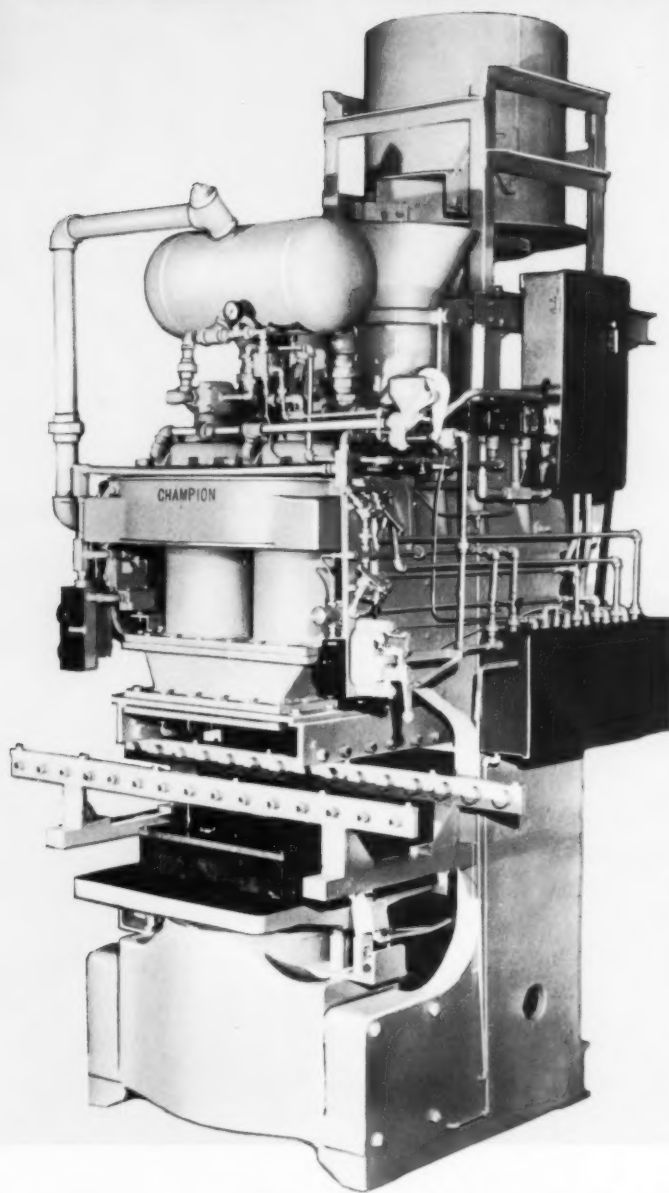
matic rotary shell Formatic unit, incorporating these components, is available for production rates of up to four shells per minute and pattern sizes of 24 x 30 inches and larger. Write today for information. Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 N. Cicero Avenue, Chicago 39, Illinois.



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***designed
for top
production
of repetitive
molds***

**BLOWS AND SQUEEZES COPE
OR DRAG IN A SINGLE
AUTOMATIC OPERATION
... HANDLES UP TO
4 MOLDS PER MINUTE**



Designed for those production foundries that must have maximum output of molds from a single pattern, or from several such patterns, the new MBS-20 Mold Blower will outperform any molding machine. Mold

sections up to 24 x 36 inches are handled and up to four complete molds can be produced each minute. From the moment the flask is rolled into the machine, until pattern is drawn from the blown and squeezed mold, all operations are fast and automatic. Molds are perfectly uniform and true to pattern.

The MBS-20 is another example of B&P leadership. B&P engineers are always busy seeking out the better method . . . the method that will increase man-hour efficiency and improve the final result. For full data on the MBS-20 write to: Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 N. Cicero Avenue, Chicago 39, Illinois.



LOOK TO
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FOR BETTER METHODS



Convention

continued from page 98

tice, with particular reference to mold thickness and backup material, were explored.

The authors found an appreciable decrease in solidification time where thin shells are backed with shot, with effects more pronounced if the shell thickness is reduced. Shells used without backup, they said, show a marked increase in solidification time. One of the most important variables is the ratio of shell thickness to plate thickness.

The effect of shot backup is limited to 30-40 percent decrease in solidification time, compared with 80-90 percent through direct application of a chill, because of the shell acts as a heat valve. The authors noted that in the case of steel, bronze, and aluminum, variations in shell mold practice have no measurable effects on the time at which the start of freeze occurs at the center, and that the time is the same as observed for sand molds.

In conclusion, Bishop, Morey, and Pellini said that no significant changes in foundry characteristics of metals should result from casting in shell molds backed by shot or gravel, although pouring in open shells may aggravate the difficulty of feeding metals which feature long delay in the development of a solid skin.

Another paper, "Solidification of Various Metals in Sand and Chill Molds," was prepared at the Naval Research Laboratories, Washington, D. C., co-authored by F. A. Brandt, H. F. Bishop, and W. S. Pellini, who presented data of solidification characteristics for a variety of important metals not previously investigated. They listed specific properties of metals which favor rapid solidification: low heat of fusion, low specific heat, short liquids to solidus range, high temperature level of solidification, high thermal conductivity of the solidifying metal. In sand molds, they said, conductivity of the solidifying metal has little effect on solidification time because the low heat diffusivity of the sand controls the rate of heat flow from the casting. In chill molds, however, conductivity is important because the rate at which heat may be moved from the center to the surface of the casting influences the rate of heat absorption by the chill.

The relative ratios of freezing time in sand compared to chill vary from four to 20, the authors said, with faster freeze in chill molds. They showed the variations in solidification time for such metals as lead, copper, 60-40 brass, several steels, monel, Mg-Al, Si-Al, and 88-10-2 bronze.

At the final heat transfer session E. C. Troy, consultant, Palmyra, N. J., presided, assisted by J. B. Caine, consultant, Cincinnati, as vice-chairman and Secretary. Two papers were presented during the meeting.

"Heat Transfer of Various Molding

Materials for Steel Castings" was the title of a paper presented by Charles Locke, West Michigan Steel Castings Co., Muskegon, Mich., and C. W. Briggs, Steel Founders' Society of America. The authors sought to evaluate the heat extracting ability of a number of materials that hold promise as moldable chills for steel castings. Twenty-five materials were tested, including silica sand, asbestos, steel shot, zircon, chamotte, powdered graphite, and copper shot. The test was the time for solidification of 6-in. steel spheres, as determined by a thermocouple at the center of the sphere casting.

Only those chills more potent than zircon, said Briggs and Locke, merit consideration, since zircon is itself an excellent moldable chill material. Steel shot, they stated, made the most potent moldable chill, but its use is limited by need for a wash, and the cost. Silicon carbide was excellent but it, too, required a wash. Magnesite was the cheapest of the materials more potent than zircon. Alumina appeared to be the most likely substitute for zircon, except for cost. Chromite, declared the authors, seems in the best position to compete economically with zircon since the cost is lower.

E. T. Myskowski, H. F. Bishop, and W. S. Pellini authored the paper, "Studies of Chill Action," also presented at the session. Various characteristics of chill action demonstrated by the authors' studies may be considered to be general, therefore, applicable to a variety of practical problems related to chill application. In the use of chills to increase feeding range between two risers, the

authors said, their investigations showed that a chill of $\frac{1}{2}T$ thickness is fully effective, on bar castings. On plate castings IT chills were required to reach maximum effectiveness.

For simplification, they indicated, chill thickness equal to the casting thickness should be used for plate-like shapes, and a chill thickness equal to one-half the casting thickness for shapes closely approaching bars. The same rules apply equally to chills applied to the end of castings to promote directional solidification, they stated.

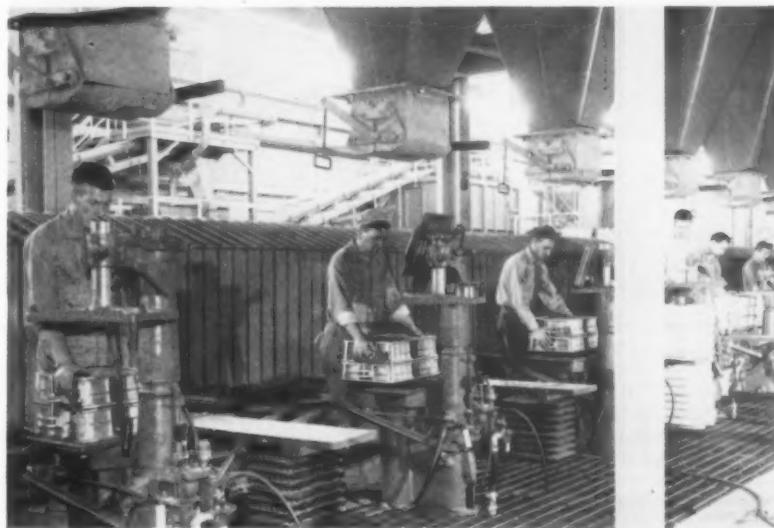
For many metals, notably steel, the use of chills involves the danger of creating hot tears in regions adjoining the chill edge, because of sharp transition in solidification rates at those points. The only approach which can be expected to counter this undesirable condition involves the elimination of the abrupt change from chill to sand at the mold surface, such as the use of a spacing layer to eliminate this effect.

In the control of hot spots, the authors continued, moderate rather than maximum chill effects are usually desired, representing a reversal of solidification conditions rather than the desired equalization. Indirect chills show ideal characteristics for use at critical hot spots which occur near the surface.

PLASTER MOLD CASTING

A SINGLE session was held by the Plaster Mold Casting Committee, on Tuesday afternoon, May 11. H. Rosen-continued on page 102

Dedicate New Fairbanks-Morse Plant



One of three gray iron molding units in new Fairbanks, Morse & Co. pump plant dedicated May 19 in Kansas City, Kan. Boasting one of the nation's most modern foundries, the new \$6,000,000 plant is evidence of management's confidence in the economic future and the future of Fairbanks-Morse, according to Robert H. Morse, Jr., president. Primary production will be castings ranging up to 2200 lb for pumps and one-cylinder gasoline engines. Daily production will run about 60 tons of gray iron, five tons of brass and bronze, and one ton of stainless steel castings. Gray iron is cupola melted and held in a direct arc furnace. Complete plant write-up will appear in future issue of *American Foundryman*.

Convention

continued from page 101

thal, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia, presided. He was assisted by G. R. Gardner, Cleveland Research Division, Aluminum Co. of America, vice-chairman and secretary. Two papers were presented.

The meeting was opened by R. F. Dalton, Hills-McCanna Co., Chicago, who authored the paper, "Improving Thermal Conductivity and Economy of Foam Plaster Molds." Foam plaster molds have slow cooling effect, or low heat conductivity, compared to green sand or permanent molds, Dalton claimed. This results from low density through the use of air and water.

Dalton discussed mixing techniques with emphasis on air and its effect on the batch. Sand may be added to the mixture, he said, to increase the heat conductivity. If needed to equalize freezing rates of heavier metal sections, chills may be used advantageously. His final point was that foam plaster used with contour chills and sand additions should

produce better aluminum castings, especially where internal chills are detrimental for soundness and pressure tightness.

Second paper to be presented was "Practical Applications for Expansion Plaster" by O. H. Harer, Scientific Cast Products Corp., Chicago. Medium high and high expansion plaster are two scientifically formulated gypsum cements having unique characteristics, Mr. Harer said. They expand uniformly in all directions and have the highest setting expansion of any known gypsum cement. High expansion plaster does not have dimensionally stable characteristics after setting, he pointed out, so it must be used when the correct expanded dimension has been reached or as soon thereafter as possible. When only a single shrink pattern is available, a matchplate can be made for production purposes directly from that pattern by using expansion plaster; replacement of a corebox can be accomplished by taking a slug from the corebox and expanding to compensate for correct shrinkage; wood or plaster models made to standard dimensions can be expanded and metal equipment produced to take care of production requirements, were several applications cited by Mr. Harer,

where medium high expansion plaster is used satisfactorily.

K. A. Miericke, Baroid Sales Div., National Lead Co., Chicago, closed the meeting with a discussion on the "History and Development of Plaster Mold Castings." He listed various locations where plaster is found in its original source. Egyptians and Chinese were the first to use plaster but their formulas were kept secret and unfortunately died with them, he said. Present aims are to get cost down, improve scope and types of metals to be cast and to simplify the process.

COST

A single Cost Committee session was held on Thursday afternoon, May 13. R. L. Lee, Grede Foundries, Inc., Milwaukee, presided; vice-chairman was George Tisdale, Zenith Foundry Co., Milwaukee. Subject for the meeting was a series of questions relating to the application of cost control principles to foundry operation.

The panel for the discussions included: A. C. Sennett, Terre Haute (Ind.) Malleable & Mfg. Co.; C. R. Culling, Carondelet Foundry Co., St. Louis; C. E. McQuiston, Advance Foundry Co., Dayton, Ohio; J. A. Wagner, Wagner Malleable Iron Co., Decatur, Ill.; and C. E. Westover, Westover Engineers, Milwaukee.

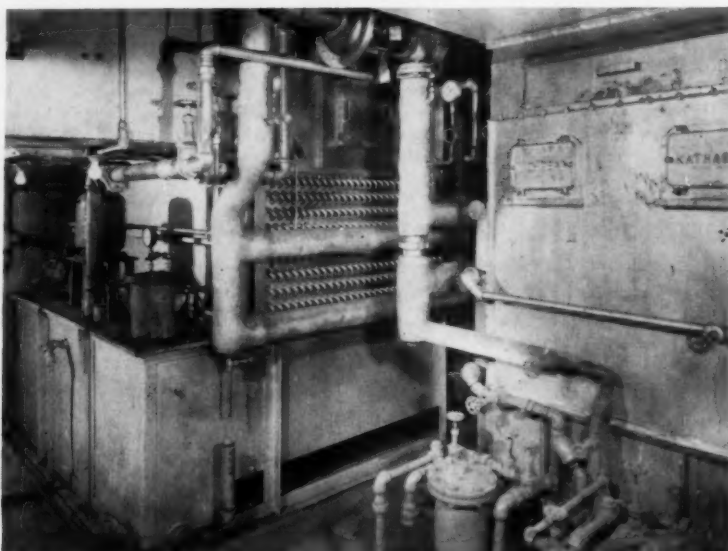
Discussed Normalized Costs

Topics brought before the meeting included problems of normalized costs, estimating rates, actual overhead rates, and frequency of review of overhead burden rates. Consideration was also given to the types of work that does not, or could not, fall within the purview of a basic cost system. One question posed the problem of whether metals should be considered as a separate cost from the melting department.

Discussion also included the necessity of yield determination for cost finding, the application of selling costs to cost of metals when arriving at total costs, core cost rate based on core weight, and the necessary use of a replacement value for the determination of depreciation costs. Gain to the company by normalizing fixed costs, and the cost of operating a cost system, were brought out during the meeting.

Publish Investment Casting Booklet

An illustrated, mimeographed booklet, "Investment Casting of SAE 1040 Steel," has just been published by the U.S. Department of Commerce. The publication specifies methods used in preparation of fatigue life and decarburization test specimens. Fifty cents and a request for PB 111198 addressed to Office of Technical Services, Commerce Dept., Washington 25, D.C., will secure the booklet.



Here's How the hot blast and humidity conditioning system used in the new malleable iron foundry at Crane Company's Chicago works helps secure the benefits of lower coke consumption, improved analysis uniformity, hotter metal and fewer casting rejects. The two new cupolas are equipped with Griffin hot blast and Kathabar chemical-type humidity control equipment. The hot blast system performs two functions, preheating the air going into the cupola and reducing the emission gases, smoke and dust to the atmosphere. Equipment utilized the heat generated by burning combustible gas from the cupola. The Kathabar equipment accomplishes the humidity control of the air stream before it enters the hot blast unit. The combination of hot blast and humidity control and electric holding furnace has resulted in significant benefits. Improved control of variables has led to greater uniformity of composition and more uniform annealing. While not all of the benefits are due to the use of the humidity conditioning equipment, it is believed that the control of cupola blast moisture is an important factor in the success of the modernizing program. Kathabar Div., Surface Combustion Corp.

For more data, circle No. 397 on p. 17

Chapter Meetings

July

17. .Northwestern Pennsylvania
Erie, Pa. "Picnicana." Annual Picnic.

30. . Wisconsin

Maple Crest Country Club. Golf Outing.

August

Washington

5 Mile Lake. Annual Outing.

PLAYING IT SMART

In ten years as a foundry man
I've often skinned my nose,
Smashed my fingers, burned my arms,
But I never hurt my toes.

The reason's very simple:
It's only that I choose
To play it smart. I always wear
A pair of safety shoes.

The other night when I retired
The baby was a-bawlin'.
I couldn't get a wink of sleep
So loudly was he squallin'.

Arising from my downy couch
To tend the little midget,
I stumbled on a table leg
And broke the largest digit
Of my left pedal extremity—

Three full weeks on crutches!
It made me pretty mad!
The only lost-time accident
Yours truly ever had!

But you'll admit I play it smart
I'm wise—I use my head.
For now I wear my safety shoes
Even when I go to bed!

From *Rammed Up and Poured*, book of foundry poems by Bill Walkins, available from the copyright owners: Electric Steel Foundry Co., 2141 North West 25th Ave., Portland 10, Oregon. Price, \$1.85.

Publish History of Wheels

Starting with a brief historical discussion of the more than 5000-year history of wheels, *Development of Wheels for Trucks and Busses*, is devoted primarily to the manufacture of wheels at George Fischer Ltd., Schaffhausen, Switzerland. Received recently by the AFS library, the book commemorates the 50 years the company has produced wheels, starting with cast-steel, spoked wheels for trucks, and the founding of the company 150 years ago by Johann Conrad Fischer.

The historical portion of the book deals with oldest known documents of Ur and comes down to the beginning of the 20th century.

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FURNACES FOR
BRASS • ALUMINUM • MAGNESIUM
AND ALL OTHER
NON-FERROUS ALLOYS

HAVE YOU INVESTIGATED THEM
FOR YOUR MELTING PROBLEMS?

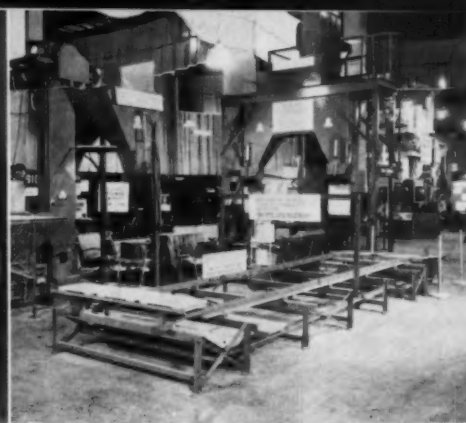
The Campbell-Hausfeld Co.

900-920 MOORE ST.

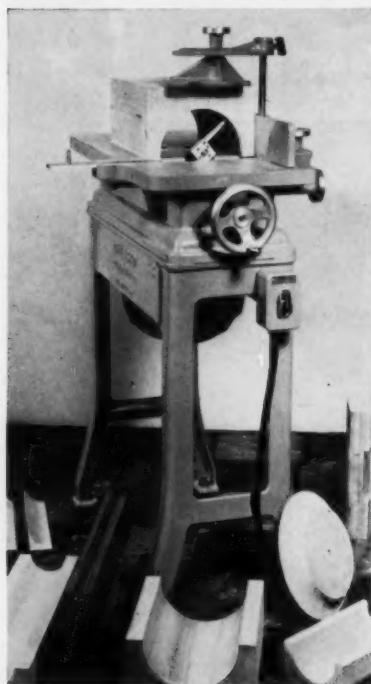
HARRISON, OHIO



Left—Sand aerator readily fits into existing conveyor set-up. Center—In foreground is pallet-car system for dumping squeezer molds, returning them to mold. In right back-



ground, super-unit of manufacturer's line supplies 30 tons of sand from overhead to two molders. Right—Convenient, portable gamma ray machine.



Machine rapidly makes boxes and fillets.

Cheaper assembly of teeming ladle stoppers in steel foundries is possible with a new design in which two drilled holes and pins take the place of the key, key hole, and bolt. The rod sleeve weight is supported by one pin and two washers, eliminating the necessity of upsetting the end of the stopper or the supporting of the sleeve weight by the head.

The problem of a satisfactory floor paving material for cupola, forehearth, holding ladle, and pouring areas has been approached by three or four large production foundries which have installed a castable refractory displayed during the exhibit.

The combined efforts of a foundry and a supplier in introducing beryllium into stainless steel have developed some improved properties in the material. The 18-8 type when so treated exhibits good age hardening properties. The corrosion resistance is increased and the results of galling tests show definite benefits.

Boron is making an appearance in the bronze foundry with a smelter and refiner offering a 2 per cent boron-copper master alloy. It may be used as a deoxidizer for high conductivity castings. Other advantages are noticeable grain refinement and improved pickling response, which result in better appearing castings. It is claimed that the addition

of 0.001 per cent boron will prevent embrittlement and make the material more workable.

Up to 80 per cent reduction in lining time is reported by users of a small, 5-lb, air-operated rammer which the exhibitor pointed out could be used for all types of patching including ladles down to as small as 8-in.

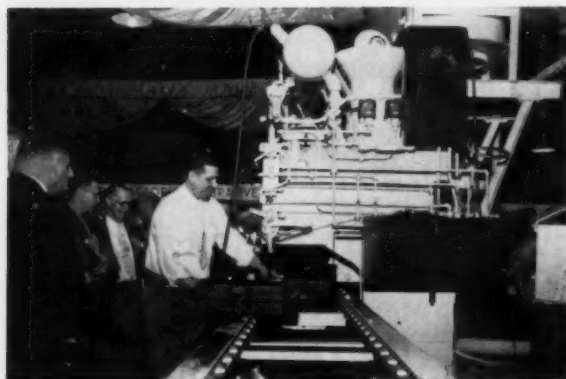
On display for the first time to AFS Show-goers was a complete line of fluxes, deoxidizers and degasifiers, exothermic compounds, and mold and die washes. A moldable exothermic material for riser sleeves was demonstrated.

A new line of ceramic strainer cores available in seven standard shapes and sizes was shown.

Melting stock and addition materials not previously shown for consideration of Convention-goers included: a new-comer in cupola briquettes; a line of aluminum pig and ingots; copper-base ingots, and copper, tin, lead, and zinc alloys; brass, bronze, and aluminum ingots, and deoxidizing aluminum; and a series of non-ferrous alloys in ingot and shot form.

In one of the booths, zircon sand and zircon flour for special molding applications, rutile for titanium alloys, and magnetite products made their first appearance under the exhibitor's name.

continued on page 106



New mold blower blows, squeezes, draws cokes at rate of one every 14 seconds, handles flasks up to 24 x 30 in., sand with green compressive strength up to 15 psi.



Above—Two-station, manually-operated shell molding machine has movable oven that cures shell on station at one end while pattern at other station goes through rest of cycle.

Obituaries

According to a cablegram received in Chicago, June 14, **Tom Makenson**, for 28 years Secretary to the Institute of British Foundrymen, died suddenly on June 10. Mr. Makenson was also Honorary Secretary of the International Foundry Congress from the date of its founding. Full details will be published in the August issue of **AMERICAN FOUNDRYMAN**.

Lloyd D. McDonald, 60, died of a heart attack in May. Since 1950 he had been executive vice-president of Warner & Swasey Co. Mr. McDonald was also vice-president and director of Sterling Foundry Co., Wellington, Ohio, and a member of the executive committee of Osborn Manufacturing Co., Cleveland.

Arthur J. Westphal, 60, was killed in an auto collision near Erie, Pa., in May. He was vice-president in charge of sales and secretary of Atlas Steel Casting Co., Buffalo, N. Y. Mr. Westphal had been associated with the organization since it was founded in 1912 and was its oldest employee in length of service. The accident occurred as he was returning from a one-day business trip to Titusville, Pa.

Raymond H. Gardiner, chairman of the board of directors, Albion Malleable Iron Co., Albion, Mich., died in April. He was chairman of the board since 1945. Mr. Gardiner served as company president twice, in 1937, and again from 1942 to 1945. He joined the company in 1905 as an apprentice molder.

Henry Duckworth, 82, retired vice-president, Norton Co., Worcester, Mass., died in Palm Beach, Fla., in April. He was associated with the firm for more than 60 years.

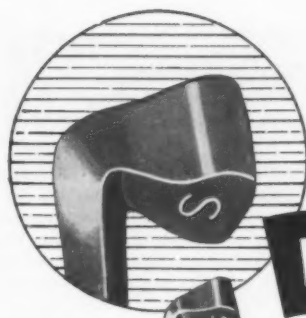
F. W. Wilkening, 73, chairman of the board, Wilkening Mfg. Co., Philadelphia, died in April. For 31 years, he was president of the company.

J. Harvey Byers, 73, president, Abrasive Products Co., Lansdowne, Pa., died in April. He was also vice-president of Exolon Co., Tonawanda, N. Y.

G. T. Van Alstyne, 62, director of advertising-publicity, Air Reduction Co., New York, died in April. He joined the company in 1919.

Charles W. Staacke, 56, technical adviser, Hewitt-Robbins, Inc., died in April.

John H. Lass, president of Acme Foundry died in April.



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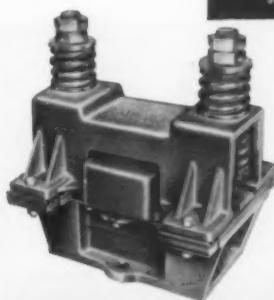
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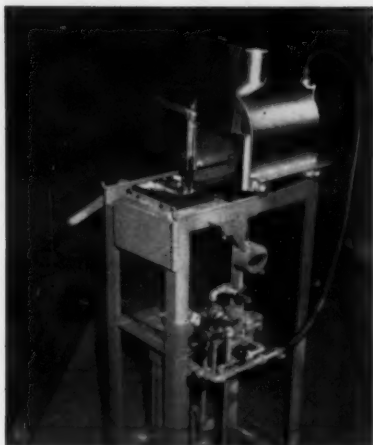
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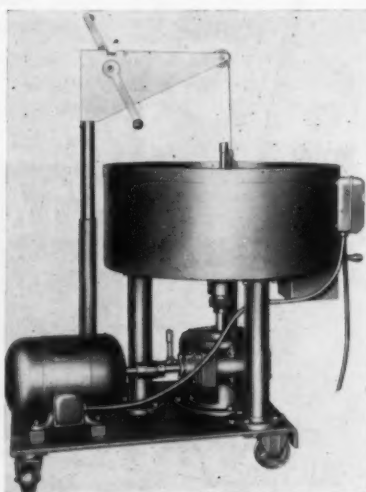
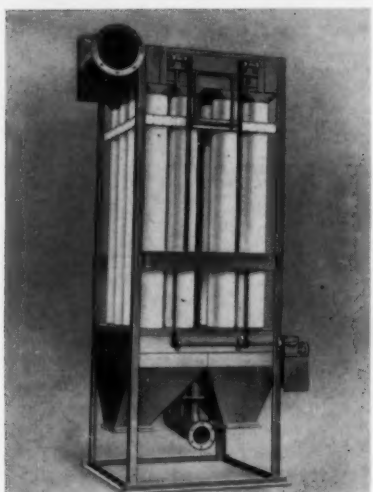


continued from page 104

Melting & Pouring

EQUIPMENT FOR MELTING and related facilities, on display for the first time, included: dual chamber furnace for non-ferrous melting and holding; low frequency induction furnace redesigned for ferrous melting; magnetic stock line indicator for cupolas; borings charger for cupola melting of machine shop turnings; direct arc furnace control which repositions electrodes in 1/20 second; self-contained wet slag disposal unit; and a tramrail system for handling molten metal.

The dual chamber furnace provides



separately-controlled melting and refining chambers designed to give rapid melting, precise temperature control, and clean, high-quality metal for die casting, sand casting, and permanent mold plants.

The low-frequency, submerged-resistor furnace exhibited seems well suited to small specialty foundries requiring semi-continuous metal.

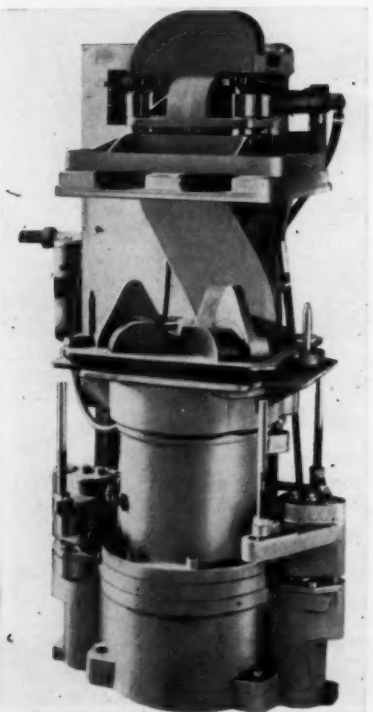
Operating on the principle of a mine detector used by armies, the magnetic stock line indicator sounds a horn, operates lights, or can be interlocked with the mechanical charging system.

The borings charging unit injects loose machine shop waste through the cupola wall just above the melting zone by means of simple pneumatic ram, thus avoiding need for briquetting.

Rapid repositioning of electrodes in the direct arc furnace using the control exhibited is reported to give lower electrode consumption, faster melting, longer refractory life, and reduced maintenance costs, among many other advantages.

Low-cost slag disposal from cupolas is obtained with the portable unit, capable of handling slag from cupolas melting from five to 25 tons an hour, which requires no pits, foundations, recirculating pumps. Slag flows into quench tank, is granulated, conveyed up and discharged into truck, cart, or conveyor.

For magnesium melting, well-designed steel crucibles of special steel composition were exhibited. A new carbon-bonded crucible, available in all standard and special shapes, was offered by another supplier for use in melting copper-base, aluminum, and other non-ferrous alloys.



Top—Small, manual shell machine is used for both molds and cores, for production and experimental work. **Middle left**—Reverse jet fabric dust collector maintains constant high efficiency. **Above**—Portable sand muller moves on casters. **Below left**—New flask-lift molding machine jolts and squeezes simultaneously. **Below**—Fire-resistant bottom board stands metal at 2900 F. **Below right**—Automatic moisture control for large or small sand system.



Shake-out & Finishing

IN THIS AREA of foundry operations, foundrymen saw on display for the first time at an AFS Exhibit; two types of pallet dumpers with bottom board return, an above the floor shake-out with belt discharge over a magnetic pulley, and a shake-out with new automatic stop control to eliminate excessive amplitude

continued on page 108



Classified

HELP WANTED

GROW WITH TEXAS. Small, fast expanding non-ferrous jobbing foundry, specializing in hi-production items. Desire man to take full charge of shop (production and maintenance). **Box B34, AMERICAN FOUNDRYMAN, 616 South Michigan Ave., Chicago 5, Ill.**

POSITIONS WANTED

Seeking supervisory position with foundry. Eighteen years of practical experience in all types of metals and alloys, castings up to 25 tons. Supervised one of the foremost foundries in the country in shell molding for two years. Willing to travel. **Box B31, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

MECHANICAL ENGINEER. Experienced in mechanized hi-production foundry. Machine tool background. Age 35. Desire position as plant engineer. **Box B32, AMERICAN FOUNDRYMAN, 616 South Michigan Ave., Chicago 5, Ill.**

STEEL MELTER. All types of steel and alloy irons, acid and basic. Electric and induction furnaces. Eight years experience, 29 years old. Desire to relocate. Prefer California or South America. **Box B33, AMERICAN FOUNDRYMAN, 616 South Michigan Ave., Chicago 5, Ill.**

FOR SALE

FURNACES FOR SALE
10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

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STEARNS MAGNETIC DRUM TYPE SEPARATOR. Capacity 22 tons sand per hour. Used few months. Priced to sell.
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WEST COAST FOUNDRY LOCATION. Ideal set-up for manufacturing cast pipe or general foundry work in fast growing San Leandro, Calif. Present foundry tenant moving July, 1954, to larger quarters. Accessible to local transportation and adjoining industries. All utilities, plus high tension power. Drill and spur tracks serviced by Southern Pacific and Western Pacific Railroads. Total ground area 59,610 square feet; foundry building contains 16,950 square feet; warehouse building contains 5,856 square feet. Modern office. Will sell or lease. Plat of buildings and property sent upon request. Contact: **Lee D. Chriss, 1736 Franklin St., Oakland 12, California. Phone GLencourt 2-2047.**

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The Type VG is ideal wherever a clean, sharp finish is desired.

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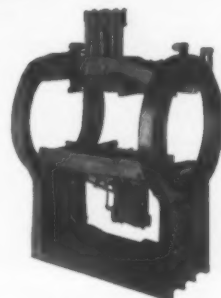
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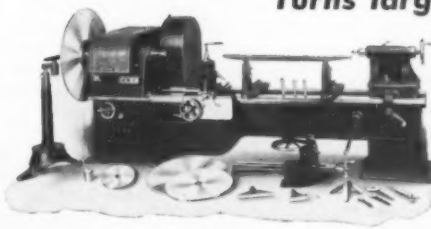
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"OLIVER"

NO. 66 GAP LATHE

Turns large patterns quickly



This Pattern Makers' Heavy Gap Lathe has many advanced features. Stock can be turned 6" between centers with gap closed, or 8" with gap open. Swings 30" over ways, 26" over carriage, and 24" long with 48" diameter in gap. Spindle rotates 86 to 1820 r.p.m. with two-speed motor. Extra heavy bed and columns maintains perfect alignment.

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Left—Directional exposure unit for up to 10,000 millicuries of Co-60. Center—Air-operated vibrating rammer for pack-



ing refractory in furnaces and ladles. Right—Melting and casting unit gives clean, high-yield permanent mold castings.



Core grinder has own dust collector or can be hooked into plant system.

continued from page 106

during stopping. A manufacturer of airless blast cleaning equipment showed a car-type room and also was one of two companies to offer special long-life liners for blast barrels. Also shown were a powder cutting and surface washing torch for riser and pad removal and clean-up of defects, a packaged unit for low-cost impregnation of porous pressure castings, and a new line of small hand grinders with larger front bearing for longer life.

One of the pallet dumpers, originally developed by a high-production malleable shop, provides for manual movement of pallets onto the dumping section which tips, allowing the unjacked molds to slide off. Pallet and boards return by gravity via a lower track and are lifted to molding position on a lifting section, relieving the molder of heavy work.

The other pallet dumper, also for squeezer floors, lifts and moves pallets and/or bottom boards up and forward to slide the molds off, then lowers to permit gravity return of pallet or wheeled bottom board. Similar to the previous

unit, dumper is installed above the floor.

The new above-the-floor shake-out, designed for low cost mechanization, is easily loaded with front-end loader, and discharges magnetically-cleaned sand into bins, piles, or other equipment.

The car-type airless blast unit handles castings weighing up to 15 tons, the car moving electrically in and out of the blast room on tracks for convenient loading and unloading by hoist.

A small, complete forge shop, including forging hammer, for making, dressing, and heat treating chipping chisels (available as a packaged unit or as individual pieces of equipment) stood out among the foundry exhibits.

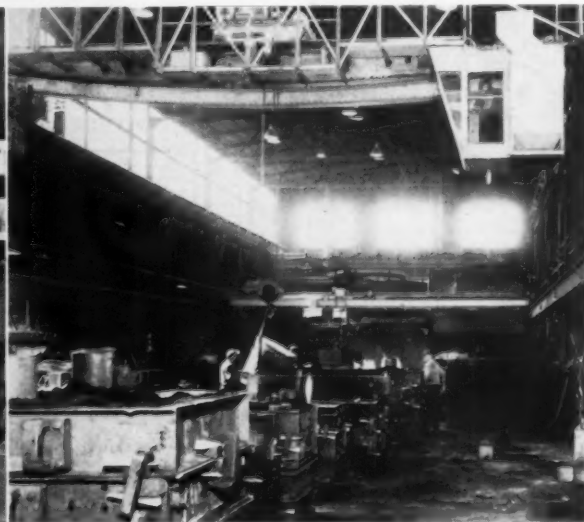
Products of other exhibitors shown for the first time included: a line of chipping chisels; shot and grit; a portable metal-cutting band saw; blast nozzles, blast cabinets and rooms; and a new grinding wheel.

For the users of airless-blast, tumble-type machines, there were rubber trunnion headwear discs.

continued on page 110



Left—Exhibitor featured process for cold precoating of sand for shell molding, blew shell cores at left end of modified



shell mold machine. Right—Crane cab cooler installation of type exhibited during AFS Show.

1954 Foundry Show Attendance List Printed

Registered Attendance List for the 1954 AFS Foundry Congress & Show in Cleveland will be available in July. Included will be the 15,000 foundrymen and sales representatives who attended to make this, the largest Foundry Show ever staged by AFS, a spectacular event.

As in previous years, the list will be geographical by states and cities, with companies listed alphabetically under each foundry center. Copies are available to 1954 exhibitors gratis on request, \$10 to others. Since the available supply is limited, orders should be sent promptly to the AFS Central Office.

Issue IBF Proceedings

Technical papers delivered at the 1952 annual meeting and business transactions of the Institute of British Foundrymen, along with selected papers presented at branch meetings, appear in *Proceedings of the Institute of British Foundrymen*, vol. 45 (1952). Papers number 32 and cover the full range of foundry technology as indicated by the following topics: role of the research foundry, metal flow, ingot mold production, production of heavy iron castings, manufacture of high-quality steel castings, trends in British steel founding, manganese steel, beryllium bronze, degassing aluminum alloys, grain refinement of non-ferrous castings, nodular iron, internal stresses, atmospheric dust in steel foundries, sand and mold wash expansion, and gamma radiography.

Other papers include those on investment casting, abrasion resistant castings, process planning, hot blast cupola, chilling and feeding, die casting, aluminum bronze, inspection, and production aids.

Correction

In the June issue of *AMERICAN FOUNDRYMAN*, reference was inadvertently made to "the late C. W. Briggs" with the implication he had been technical director of the Gray Iron Founders' Society. Mr. Briggs is alive and active as technical and research director of the Steel Founders' Society. Reference intended was to the late C. O. Burgess whose post as technical director of G.I.F.S. was recently filled by Charles F. Walton.

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base; Gap, 10", 13" high or unlimited.
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Above—New design cyclone dust collector was shown powered by portable vacuum cleaner. Collector is reported to trap material four microns and under, to have 99 per cent efficiency.

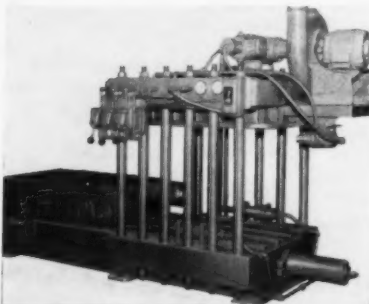
Right—Diaphragm molding machine gives uniform pressure on mold; diaphragm literally "wraps around" pattern to give high density molds for precision casting.

continued from page 108

Safety, Hygiene, Air Pollution

ALONG WITH NEW PROCESSES and products go changes in methods of achieving safer, cleaner foundries. Comments of suppliers of dust control and safety equipment indicated they have a sincere desire to help make the foundry a better place in which to work. Production men revealed that they felt that good housekeeping was paying off.

Problem of dirty water and sludge disposal is solved by means of a new combination of equipment which treats waste water from wet sand reclamation, wet dust collectors, etc., in a chemical



treatment unit, a tank for solids concentration, followed by vacuum filtration. Results is clarified, re-usable water and easily handled waste solids.

A complete new line of air pollution control equipment for melting operations that can be integrated with waste heat recuperators was featured in one exhibit. Also shown by the same manufacturer was a new safety feature in a tuyere elbow incorporating a check valve which prevents back-up of gases.

Another manufacturer featured a new high efficiency cyclone unit for which high efficiency is claimed, even at 50 per cent of rated capacity. The same company also featured a reverse jet bag filter designed to maintain highest possible filter efficiency at all times.

A new wet centrifugal collector intended to collect extremely fine materials such as resin, seacoal, bentonite, etc., was shown by a supplier who also exhibited for the first time a new high-efficiency collector to be sold as a packaged unit.

Known for its crane cab coolers, another manufacturer exhibited collecting units which can be added to the coolers for removal of dust particles. By the addition of further equipment, fumes and obnoxious gases can be removed.

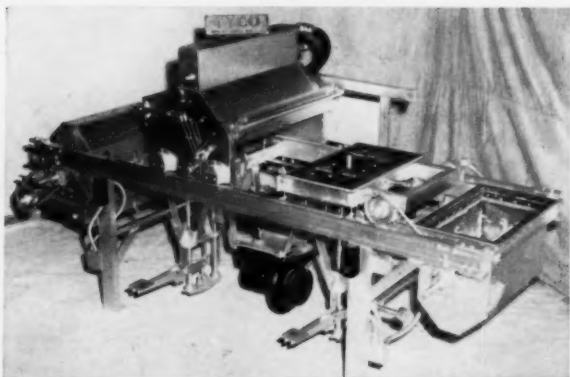
A high efficiency cyclone dust collector of a design used by the Atomic Energy Commission for material four microns and under was claimed to have an efficiency of 99 per cent or better without



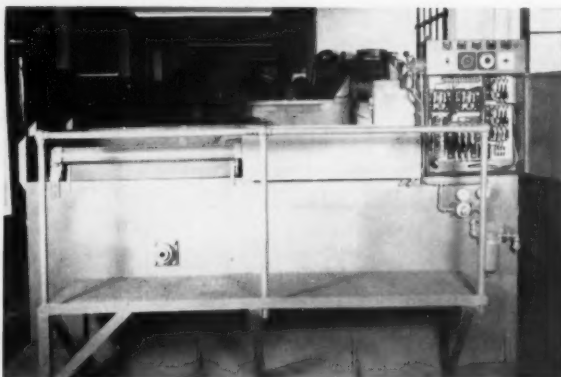
Mold blower uses quick-release flasks, is serviced by roll-off conveyor and roll-over unit, has 14-second automatic cycle.



Line of hoists includes range of chain and power equipment, features light-weight aluminum series.



Shell molding machine has two stations, is semi-automatic, has hot-air curing oven, features quick pattern changes.



Push-button operated shell mold equipment with usable pattern area of 18 in. x 24 in.

the use of bags. It was powered by a portable vacuum cleaner unit.

Radiant heat protection is offered by a new line of aluminized asbestos clothing exhibited.

For ventilating areas containing corrosive or acid fumes, one manufacturer has added all-plastic ventilators to his line.

One manufacturer featured a line of bag-type collectors for fine particulate matter ranging in capacity from 200 to 20,000 cfm. High efficiency is achieved with these units by keeping them free of accumulated dust by means of a constantly moving reverse jet.

A line of motor sweepers not previously exhibited indicates the trend toward better housekeeping in the foundry industry. Numerous types of equipment for moving air were on display with new exhibitors offering airfoil fans and blowers, turbo-blowers, axial fans, propeller fans, centrifugal fans, and power roof ventilators.

A hydro-filter designed for dust collection use with the manufacturer's own pneumatic sand reclamation equipment was reported also available separately for solving foundry dust problems.

Another newcomer on the AFS Exhibit scene was an industrial laundry service which also cleans and repairs safety clothing and equipment.

Shell Molding

EVIDENCE THAT MANUFACTURERS are keeping abreast of interest in shell molding is found in the 12 exhibits which featured shell molding machines, along with the nine displays of resin and release agent producers. All the equipment manufacturers in this field featured improvements designed to simplify and speed production with several offering shell coremaking by blowing or dumping. One producer of small equipment for development work and production of small parts operated a machine that made shell cores and shell molds simultaneously. Facilities available to the foundryman as shown by the exhibits cover a wide range of shell size and operation—manual, semi-automatic, and automatic, and include both single and multiple station machines.

For the shell molder, whether blowing or dumping sand-resin mixes, methods of pre-coating sands with resin, and a liquid resin new in the field, were of special interest. Advantages reported are elimination of dusting, markedly shortened dwell and cure time, denser shell (in case of blowing), and up to 50 per cent saving in resin.

One manufacturer offered a complete pour-off system for shell mold shops in a display that showed that shell-molded castings approximately six feet long are feasible. The pour-off set-up includes a roll conveyor loop, storage hopper for back-up sand or shot, hoist for dumping shot boxes, shake-out screens for separating back-up material, and bucket elevator for returning shot to storage hopper.

Patternmaking

PATTERNMAKING saw much of the same excellent equipment they're accustomed to finding at an AFS Exhibit. Several new exhibitors in the pattern lumber field showed their materials as did a shop producing pressure-cast matchplates, cope and drag plates, core boxes, and driers.

One supplier offered a Peruvian wood which has been undergoing tests for some five years and is reported to be lighter than white pine, to work well, and to hold its shape, even in thin sections.

Another producer showed special laminated planking prepared solely for patternmaking. Absence of knots, holes, pitch pockets, and other defects make all of the lumber ready for immediate use and the vertical laminations eliminate distortion.

A core box and fillet machine demonstrated, handled diameters of 11/16 to 6½ in. for core boxes and 11/32 to 3¼ in. radius fillets. Set up time is 10 minutes and cuts on long, straight lengths or on elbows up to a 6-ft bend are possible.

Testing & Inspection

MODERN EQUIPMENT for use with radioactive isotopes in gamma radiography, a conductivity meter for sorting and testing materials, a new design impact tester for core sag, equipment boron determination by distillation, and a direct reading spectrometer were shown for the first time at the 1954 AFS Convention.

One supplier offered, among other related equipment, a directional exposure shield for convenient use of the Co-60 equivalent of a 2,000,000 volt x-ray machine. Another supplier in the same field showed smaller gamma ray machines as well as larger equipment for single and

multiple exposures, and exposures using the protruded source technique.

The conductivity meter not only measures conductivity, but sorts mixed non-magnetic materials, determines degree of age hardening in light alloys, and makes indirect hardness measurements. It operates on a wide variety of non-magnetic materials including many stainless steels, aluminum, magnesium, brass, bronze, lead, etc.

The direct reading spectrometer provides the melter with 5-minute service from sample to report on analysis. Once calibrated, operation of the equipment is automatic, after insertion of sample and pushing the start button.

Special Casting Methods

A PRECISION investment casting method which does not require an expendable pattern was featured in the booth of one of the overseas exhibits, a British firm.

A unique furnace which permits casting by inverting the furnace over the mold appealed particularly to permanent mold casters. Metal is delivered from below the molten metal surface, the molten bath providing the riser metal. Result is adequate feeding and high yield.

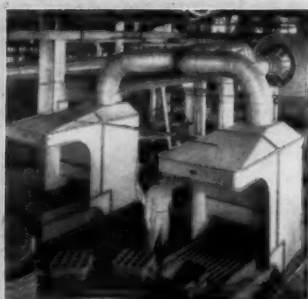
Miscellaneous

THIS YEAR'S AFS EXHIBIT hit a new high in miscellaneous equipment and components with manufacturers displaying the following: gear sets and speed reducers; hydraulic crane scales; valves for air, vacuum, and low pressure hydraulics; a solenoid pilot operated control valve demonstrated in operation under water and under a stream of sand; a line of light and heavy-duty vibrators; and a belt-driven vibrator for heavy applications.

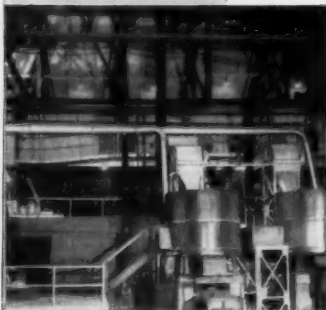


Fred Head, right, administrative assistant, Malleable Founders' Society, presenting the Safety Self-Improvement Award to Joseph Kropka, center, foundry superintendent, Chain Belt Co., Milwaukee, as A. W. Bathke, safety director, Chain Belt Co. looks on. Plant was the winner, in the group of 100 to 200 employees, of the annual Self-Improvement Safety Contest conducted by the Malleable Founders' Society.

from **START**
to **FINISHing**



SHAKE-OUT—Kirk & Blum "Production Line" hoods control dust, give unobstructed working area; wet collection.



SAND HANDLING—Dust control connections to Simpson Mixers in right foreground; wet collection.



GRINDING-SNAGGING—Battery of double grinders exhausted by Kirk & Blum system; dry collection.



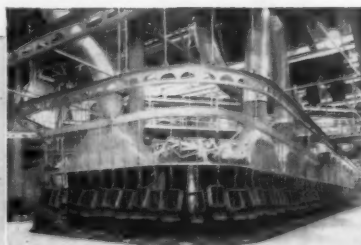
COOLING—Large volume of air passing through cooling tunnel removes fumes, cools molds.

in foundries, it's **KIRK and BLUM**

You'll find KIRK & BLUM Systems in leading foundries. To control dust and fumes from all foundry operations count on KIRK & BLUM for the complete job—design, fabrication and installation.

From 47 years of experience, Kirk & Blum Engineers have gained skill that can be used effectively in your foundry, large or small. For a no-obligation survey or further information, write: The Kirk & Blum Mfg. Co. 3108 Forrer Ave., Cincinnati 9, Ohio.

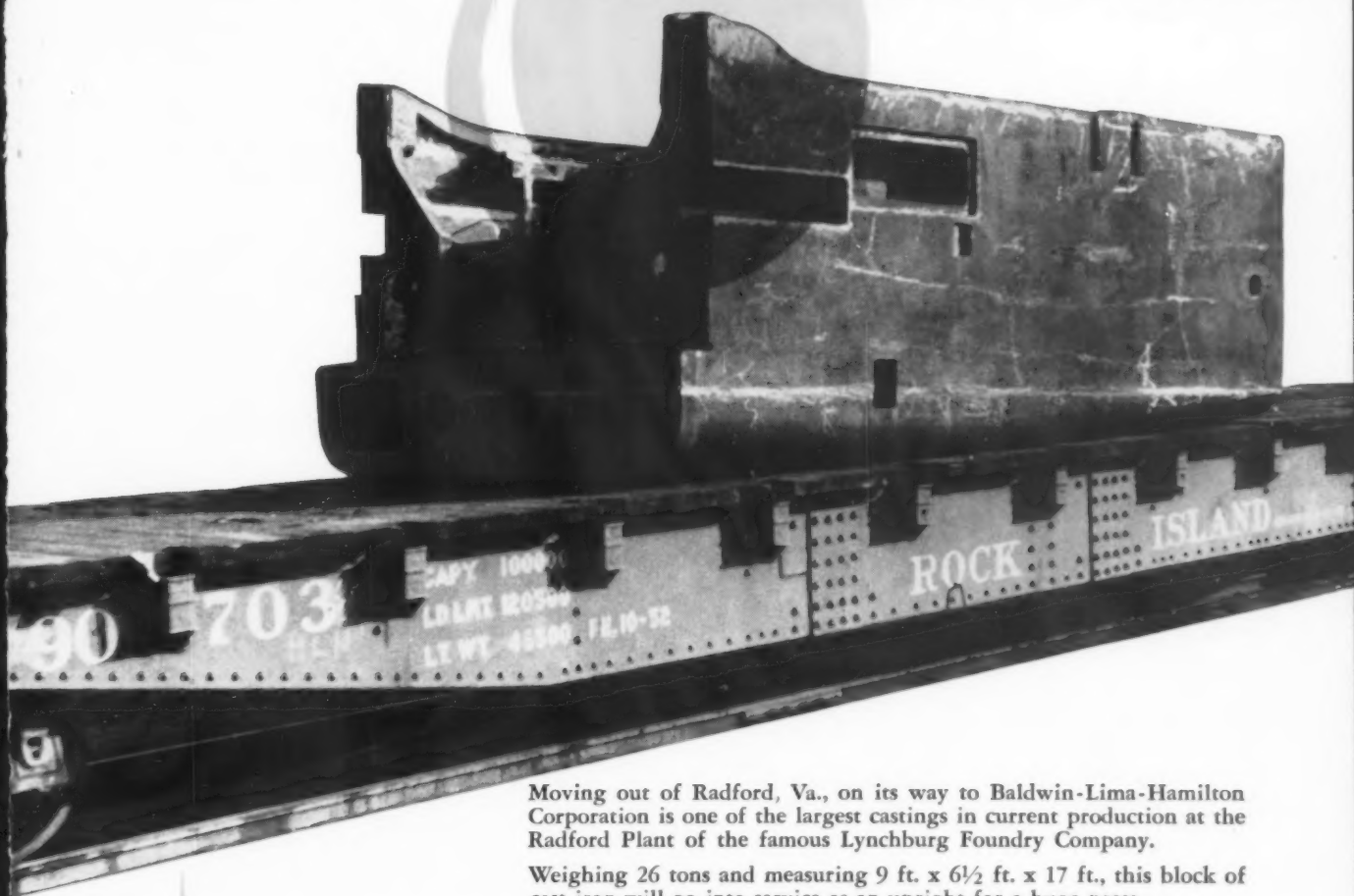
KIRK^{AND} BLUM **DUST and FUME CONTROL SYSTEMS**



POURING—Hood collects fumes over entire length of moving floor, "pouring" station.

Gigantic casting by Lynchburg Foundry Co.

takes 118 gallons of LINOIL



Moving out of Radford, Va., on its way to Baldwin-Lima-Hamilton Corporation is one of the largest castings in current production at the Radford Plant of the famous Lynchburg Foundry Company.

Weighing 26 tons and measuring 9 ft. x 6½ ft. x 17 ft., this block of cast iron will go into service as an upright for a huge press.

The cores used in producing this casting tip the scales at 35 tons! When you estimate the time, manpower, and materials involved, you can imagine the responsibility placed upon the core department.

Lynchburg Foundry, whose skill is universally recognized, has found that LINOIL is good insurance against faulty cores. Rigid quality control keeps LINOIL uniform, shipment after shipment.

Why not call your ADM Representative today—ask him to ship a trial drum of LINOIL to your plant.

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NOW...

FROM BUS SIGNAL TO ARC CORRECTION IN

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It's the Whiting Hydro-Arc Electric Furnace Control... a control that repositions electrodes automatically within 0.05 seconds after a signal is received from the electrode bus that the arc is off-balance. Maximum speed and response because: (1) usually interposed special machinery is eliminated, (2) lost motion is eliminated, (3) friction losses and inertia are reduced and, (4) the load is counterbalanced with an air cushion. Essentially a closed system, the Whiting Hydro-Arc Control uses uni-directional electrode motors that run only in one direction... *never reverse*. Watt (furnace heat) input is regulated from an external, fixed, unwavering standard.

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Send for Bulletin FO-10...
it tells the entire story of the
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